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U.S. Department of the Interior

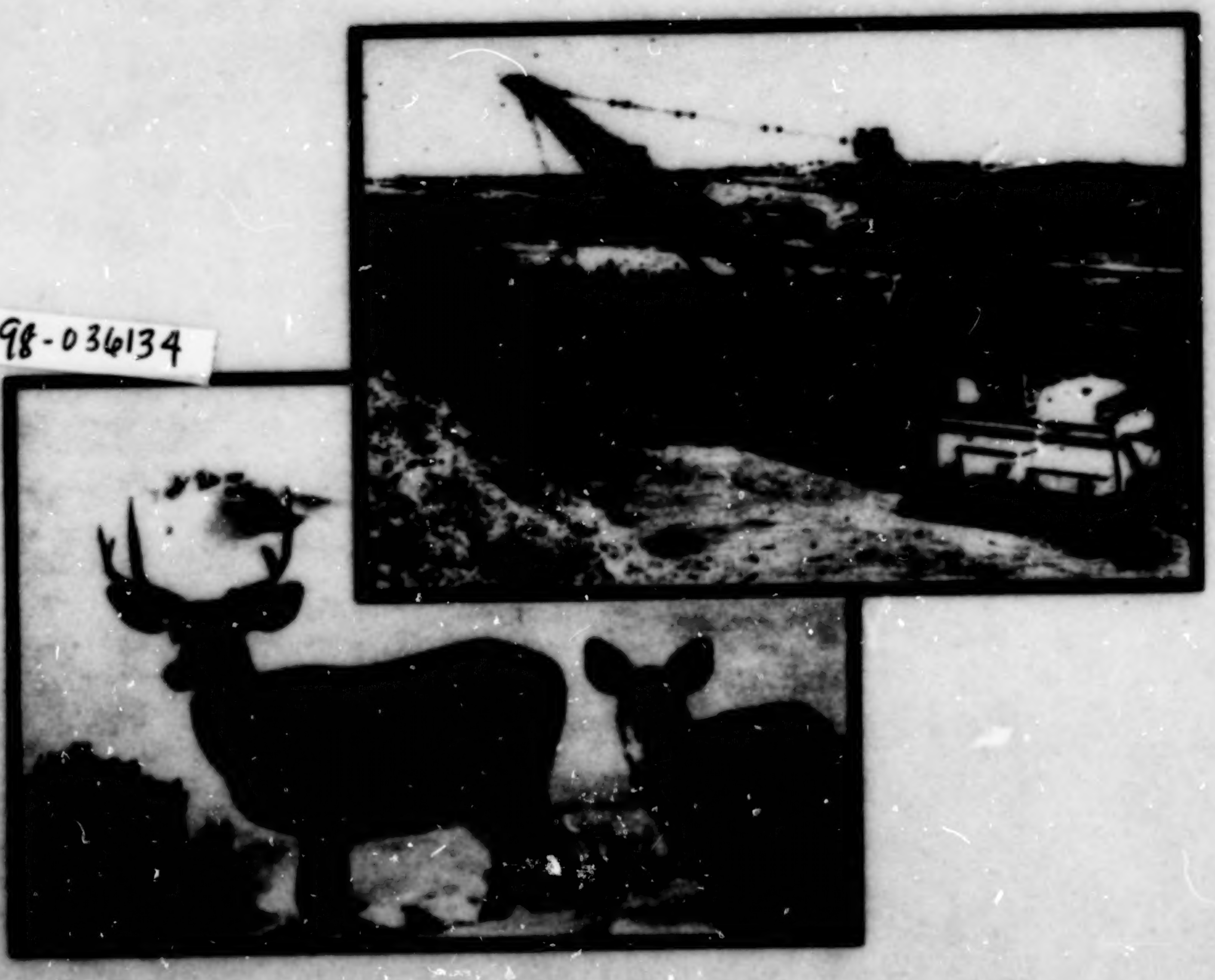
Bureau of Land Management
Rawlins District
Great Divide Resource Area

Office of Surface Mining
Reclamation and Enforcement

August 1990

DRAFT
Carbon Basin Coal Project Environmental Impact Statement

98-036134



MISSION STATEMENT

It is the mission of the Bureau of Land Management to sustain the health, diversity, and productivity of the public lands for the use and enjoyment of present and future generations.

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AUG 28 1998

United States Department of the Interior
BUREAU OF LAND MANAGEMENT
Wyoming State Office
P.O. Box 1828
Cheyenne, Wyoming 82003-1828

In Reply Refer To:

3420 (930)
WYW 139975
Elk Mountain/
Saddleback Hills

28 JUL 1998

Dear Reader:

This Draft Environmental Impact Statement (DEIS) has been prepared pursuant to 40 CFR 1500-1508 for the Elk Mountain/Saddleback Hills coal lease application located in Carbon County, Wyoming. The copy of the DEIS is provided to you for your review and comments. This DEIS is not a decision document. Its purpose is to inform the public of the impacts of leasing and mining the Federal coal proposed for leasing and to evaluate alternatives to the proposals.

The DEIS describes two alternatives in detail, including BLM's preferred alternative to hold a coal lease sale for 5235.15 acres of Federal coal lands in the Carbon Basin coal area containing approximately 6 million tons of surface minable coal and 88 million tons of underground minable coal reserves.

A formal hearing on the proposed Elk Mountain/Saddleback Hills coal lease application will be held at 7 p.m. on September 9, 1998, at the Town of Hanna Administrative Office, 301 S. Adams, Hanna, Wyoming. The purpose of the hearing is to receive comments on the proposed coal lease sale, on the fair market value, maximum economic recovery of the Federal coal resources in the proposed tract, and on the DEIS. At 6 p.m., prior to the hearing, there will be an open house to answer questions related to the coal lease-by-application process and this coal lease application.

Copies of the DEIS are available for inspection at the following locations:

Bureau of Land Management
Wyoming State Office
5353 Yellowstone Road
Cheyenne, Wyoming 82009

Bureau of Land Management
Rawlins District Office
1300 N. Third Street
Rawlins, Wyoming 82301

The public comment period will close 60 days after the Environmental Protection Agency publishes their Notice of Availability of the DEIS in the Federal Register. The date of publication is anticipated to be August 14, 1998. In addition to comments received on the DEIS, the BLM will also consider comments on the issues of fair market value and maximum economic recovery of the coal tract. All responses received by the end of the public comment period will be reproduced in the Final Environmental Impact Statement

(FEIS). Comments received after that date will be considered and reproduced in the FEIS, if time permits. Please address written comments to the Bureau of Land Management, Great Divide Resource Area Office, Attn: Karla Swanson, 1300 N. Third Street, P.O. Box 2407, Rawlins, Wyoming 82301. Written comments may also be faxed to 307-328-4224.

Comments, including names and street addresses of respondents, will be available for public review at the addresses listed above during regular business hours (7:45 a.m. - 4:30 p.m.), Monday through Friday, except holidays, and may be published as part of the FEIS. Individual respondents may request confidentiality. If you wish to withhold your name or street address from public review or from disclosure under the Freedom of Information Act, you must state this prominently at the beginning of your written comment. Such requests will be honored to the extent allowed by law. All submissions from organizations or businesses, and from individuals identifying themselves as representatives or officials of organizations or businesses, will be made available for public inspection in their entirety.

Please retain this DEIS for future reference. If the FEIS for this action is published in an abbreviated format, you will need both documents to review the entire EIS.

If you have any questions, or require additional information, please contact either John Spehar, Environmental Coordinator, at 307-328-4264 or Brenda Vosika Neuman, Team Leader, at 307-328-4389.

Sincerely,

Alan L Kesterke

for Alan R. Pierson
State Director

DRAFT

CARBON BASIN COAL PROJECT ENVIRONMENTAL IMPACT STATEMENT, CARBON COUNTY, WYOMING

Prepared for

U.S. Bureau of Land Management
Rawlins District
Great Divide Resource Area
Rawlins, Wyoming

and

U.S. Office of Surface Mining
Reclamation and Enforcement
Region V
Denver, Colorado

By

TRC Mariah Associates Inc.
Laramie, Wyoming
MAI Project 20241-01

August 1998

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DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR THE CARBON BASIN COAL PROJECT, CARBON COUNTY, WYOMING

(X) Draft ( ) Final

U.S. Department of the Interior
Bureau of Land Management

Abstract:

This Draft Environmental Impact Statement (DEIS) assesses the environmental consequences of a federal decision to offer 5,235.15 acres of federal coal lands located in the Carbon Basin, Carbon County, Wyoming, containing approximately 149.7 million tons of federal coal, for a competitive lease sale subject to standard and special stipulations. The tract was applied for by Ark Land Company, St. Louis, Missouri, and would be mined by Arch of Wyoming, LLC, an affiliate of Ark Land Company, who has operated mines in the adjacent Hanna Basin since 1972. The proposed project entails the development, operation, and reclamation of a surface and an underground coal mine using conventional surface and underground mining methods. Mine development would begin in 1999; surface mining would occur for approximately 13 years (through final reclamation); and underground mining would commence in 2005 and continue through 2023. A 115-kilovolt power line would be constructed and connected to one of two sources—the Western Area Power Administration substation near Medicine Bow, Wyoming, or PacifiCorp's 230-kilovolt transmission line (currently under construction to serve SeaWest Energy Corporation's windpower generating facility)—to supply power to the mine. Coal would be transported from the mine area north to the Union Pacific Railroad mainline; 10 transportation options are analyzed in this DEIS. The proposed mine would be constructed, operated, and reclaimed in accordance with Wyoming Department of Environmental Quality and U.S. Bureau of Land Management rules, regulations, and guidances to ensure that project impacts are minimized on all important resources. Impact to most resources would not be significant. Potentially significant impacts resulting from the project include: mining and eventual consumption of the coal resource; by-pass of unrecoverable coal; loss of life and property arising from traffic accidents due to increase traffic, including haul truck traffic, on local roads; and temporary disturbance of pronghorn and mule deer crucial winter range and overlapping crucial winter range, sage grouse breeding/nesting and wintering habitat, and mountain plover foraging and nesting habitat. The proposed project would also have numerous beneficial impacts including continued and increased employment, increased revenues generated by taxes, and related economic benefits.

Comments on the EIS should be directed to:

Area Manager
Bureau of Land Management
Rawlins District, Great Divide Resource Area
1300 N. 3rd
Rawlins, Wyoming 82301

For further information, contact Brenda Vosika-Neuman or John Spehar at the Great Divide Resource Area, (307) 328-4200.

Date DEIS made available to Environmental Protection Agency and public: August 7, 1998.

EXECUTIVE SUMMARY

Ark Land Company (Ark), St. Louis, Missouri, has filed a lease-by-application (LBA) with the U.S. Bureau of Land Management (BLM), Wyoming State Office, to obtain a federal coal lease (WYW 139975) pursuant to provisions found at 43 Code of Federal Regulations (CFR) 3425.1. The proposed lease area is located in the Carbon Basin, Wyoming (see Figures 1.1 and 1.2), within the BLM's Great Divide Resource Area (GDRA) approximately 3 miles (mi) north and northeast of Elk Mountain and 10 mi southeast of Hanna, Wyoming, on a mixture of federal, state, and private surface ownership; coal ownership is also mixed. Ark owns some of the surface and has obtained rights from other surface owners to access state and private land.

The Carbon Basin Coal Project Area (CBCPA) encompasses 18,360 acres. The CBCPA boundary encompasses the area for which Arch of Wyoming, LLC (Arch), an affiliate of Ark, will apply for permits to mine from the State of Wyoming and was determined by Arch based on surface landownership patterns and coal distribution. The LBA area (see Figure 1.2) encompasses 5,235.15 acres of federal mineral estate located in 11 discontinuous parcels interspersed through private and state lands and contains approximately 149.7 million tons of federal coal. A more precise estimate of minable reserves in the federal tract, based on detailed geological and engineering evaluations, would be included in the tract sale notice.

The federal coal, which makes up approximately 39% of the total estimated reserve (see Table 1.1), would be combined with state and private holdings to develop a feasible mining unit. If BLM decides not to lease the federal coal on these 5,235.15 acres to Ark, the private and state holdings would likely be surface mined, and the federal surface-minable coal would be bypassed.

If not mined at this time, it is unlikely that federal surface-minable coal would be leased or mined in the future because the federal coal lands are too discontinuous to form a feasible mining unit. Furthermore, if the federal coal is not leased, underground mining of private and state coal would not be economically feasible at this time. The federal underground-minable coal could be leased at a later date and mined in conjunction with private and state underground-minable coal, so not leasing the underground-minable coal at this time would not preclude its future recovery.

The LBA process is, by law, an open, public, competitive, sealed-bid process whereupon the coal lease is granted to the highest bidder. Although a company other than Ark could possibly be granted a lease, the analysis presented in this environmental impact statement (EIS) is based on the assumption that Ark, as the owner of much of the surrounding coal, would be the successful bidder and Arch, an affiliate of Ark, would mine the coal. Both Ark and Arch are owned by Arch Coal, Inc. In the unlikely event that another company is the qualified bidder on the LBA tract, the lease would not be issued until additional environmental analysis is completed.

To process an LBA, BLM must evaluate the quantity, quality, maximum economic recovery, and fair market value of the federal coal and fulfill the requirements of the *National Environmental Policy Act of 1969* (NEPA). This EIS is intended to provide both the public and agency decisionmakers with a complete and objective evaluation of impacts likely to result from the Proposed Action (the leasing of 5,235.15 acres) and its reasonable alternatives and was prepared in compliance with the NEPA and applicable regulations and laws passed subsequent to NEPA, including Council on Environmental Quality (CEQ) regulations (40 CFR, Part 1500-1508); U.S. Department of the Interior (USDI) guidelines in *Departmental Manual 516, Environmental Quality* (USDI 1980); guidelines listed in the BLM *NEPA Handbook, H-1790-1* (BLM 1988); BLM's desktop reference *Overview of BLM's NEPA*

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Process (BLM 1996); and ***BLM Guidelines for Analyzing and Documenting Cumulative Impacts*** (BLM 1994a).

The federal government maintains a policy to encourage private industry in the economically sound and orderly development and mining of domestic reserves, and the Secretary of the Interior has responsibility to carry out this policy. Since the passage of the *Mineral Leasing Act of 1920*, as amended (MLA), the USDI, through its implementing agency the BLM, has been charged with administering a leasing program that would allow the private sector to mine federally owned coal reserves. Furthermore, pursuant to the *Mining and Minerals Policy Act of 1970*, "it is the continuing policy of the Federal Government in the national interest to foster and encourage private enterprise in 1) the development of economically sound and stable domestic mining, minerals ... industries, 2) the orderly and economic development of domestic mineral resources, reserves ... to help assure satisfaction of industrial, security, and environmental needs."

Ark proposes to obtain a federal coal lease on 5,235.15 acres for surface- and underground-minable coal, which would grant Ark the exclusive right to obtain mining permits for, and to mine, coal on the leased tract (see Figure 1.2). Arch would develop and operate two mines: the Elk Mountain Mine for surface-minable coal and the Saddleback Hills Mine for underground-minable coal. Mining operations would be subject to the terms of the lease, the mine permits (two state permits would be required--one each for the surface and underground mines), federal mining plan approval, and other applicable state and federal laws and regulations. Arch presently operates two surface coal mines (Medicine Bow and Seminoe II) in the vicinity of Hanna, and issuance of the new coal lease in the Carbon Basin would enable Arch to extend the life of mining operations in the area by 20 years and to continue supplying coal to existing customers, as well as to develop new contracts.

Ark currently has 93,700,000 tons of coal leased at the Seminoe II and Medicine Bow Mines in the Hanna Basin north of the CBCPA (see Figure 4.1), 70,000,000 tons of which have been mined. Current reserves are estimated at 23,700,000 tons, 3,100,000 tons of which are economically recoverable reserves and will be depleted by 2000 at current production rates. Without supplemental reserves, no additional coal will be available for Arch to meet electric utility demands for low-sulfur coal to provide the U.S. with electrical power and to comply with the *Clean Air Act* and amendments.

The primary federal action associated with the Proposed Action would be to hold a lease sale for the 5,235.15 acres of federal coal lands in the project area. For the purposes of this EIS, 10 transportation options (e.g., over-the-highway haulage, railroad, new haul road haulage, conveyor) were developed to transport coal from the CBCPA north to the Union Pacific Railroad mainline (see Figures 2.4-2.8 and Table 2.11). Access to federal land for the construction, operation, and reclamation of any of the transportation corridors would be authorized by BLM through the issuance of rights-of-way (ROWs), an action that would also require NEPA analysis. The environmental consequences of constructing, operating, and reclaiming each of the transportation options are evaluated in this EIS, such that, if Arch applies for a ROW grant that is analyzed herein, BLM may issue the ROW grant using an Administrative Determination that references this EIS for NEPA compliance. If Arch's application differs to a degree that is not deemed to have been adequately treated in this EIS, BLM may opt to supplement the EIS prior to making a decision on whether or not to issue the ROW. The Record of Decision for this project will include a decision on whether or not to lease the LBA tract as described for the Proposed Action, a decision on all stipulations to be added to any coal lease, and a list of transportation options that BLM deems acceptable for ROW grant issuance. These transportation options would then be evaluated by Arch and Wyoming

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Department of Environmental Quality (WDEQ) during the permitting process. If BLM determines that one or more of the options are environmentally unacceptable, the unacceptable options will be stricken from the Proposed Action as described in the Record of Decision and these options would not be available to Arch. The analysis assumes that BLM would grant the necessary ROWs. If federal coal is not leased, BLM would grant the ROWs needed to facilitate mining the privately owned coal.

The public will be able to comment on the transportation options during review of the draft and final EISs, during development of the mine permit (WDEQ has built-in public comment periods), and when BLM issues any ROWs. Therefore, as Arch finalizes plans for mine development, there will be several opportunities for public comment on the proposed coal transportation plan. If a completely new transportation plan is developed and a BLM ROW is required, additional NEPA documentation will be required and will include public involvement pursuant to NEPA.

The leasing of federal coal is an integral part of the BLM Federal Coal Management Program of 1979 under authority of the MLA, the *Federal Land Policy and Management Act of 1976* (FLPMA), and *Federal Coal Leasing Amendments Act* (FCLAA). FCLAA requires that lands considered for leasing be included in a comprehensive land use plan. In 1982, a federal coal lease was issued for approximately 60% of the federal coal lands located in the Carbon Basin. Because that lease was still in effect at the time the Resource Management Plan (RMP) was prepared (BLM 1990), it was exempt from the coal screening/planning requirements, and therefore, there was no coal planning decision for federal coal lands in the Carbon Basin area included in the RMP. This lease was never developed and expired in 1992. Therefore, when Ark submitted their coal lease application, the application was not in conformance with the existing land use plan. An RMP review was conducted by BLM in 1997/98 (*Environmental Assessment* [EA] *for Coal Planning Decisions in the Carbon Basin Area of the Great Divide Resource Area* [Planning Review EA]) (BLM 1997a), and the decision was made to designate the area as acceptable for further consideration for coal leasing and development. The Federal Coal Management Program of 1979 established four major steps--referred to as the coal screening process--to be used in the identification of federal coal areas acceptable for coal development. The process includes:

- identification of coal development potential, including coal resource information (43 CFR 3420.1-2);
- application of the coal unsuitability criteria (43 CFR 3461);
- multiple use conflict evaluation (43 CFR 3420.1-4(e)(3); and
- surface owner consultation.

Only those federal coal lands found acceptable for coal development by the screening process are given further consideration for leasing.

During the RMP planning review and preparation of the EA described above, these four steps were applied to lands that include the proposed project area. These lands were found acceptable, and the RMP was amended to identify those areas in the Carbon Basin as open to consideration for coal leasing and development. The proposed lease area represents 35% of the leasable area in the Carbon Basin. Details of the screening process and results are included in the Planning Review EA (BLM 1997a).

Key issues and concerns identified by the public, BLM, and other governmental organizations regarding the proposed project and analyzed in this EIS include the following:

- analysis of alternative coal-hauling routes and methods;
- conformance with GDRA RMP;
- cumulative impacts;
- public safety and travel/transportation management;
- road maintenance;

- social and economic effects on local communities;
- revenue generation and job availability;
- surface and groundwater impacts;
- direct and indirect wildlife habitat loss;
- big game winter range and migrations;
- threatened, endangered, candidate, and state sensitive species and their habitats;
- noise impacts on residents;
- protection of cultural resources and Native American spiritual values and compliance with applicable laws and Executive Orders;
- loss of recreational opportunities;
- air quality impacts;
- effects of the No Action Alternative; and
- impacts to Medicine Bow River and Seminoe Reservoir.

Other issues and concerns identified during the scoping process and analyzed in this EIS include:

- visual resources and aesthetics;
- noxious weed control;
- highly erodible and unstable soils;
- wetlands, wetland functions and values, waters of the U.S., riparian areas, and alluvial valley floors;
- paleontological resources;
- conformance with current and future land uses;
- impacts to existing pipelines;
- increased traffic on roads and increased human activity in the lease area;
- potential for underground mining;
- impacts to existing water rights;
- impacts to other mineral resources (including oil and gas) and conflicts with other mineral development proposals;
- construction of electric transmission facilities;
- reclamation standards and procedures;
- disclosure of any and all of the applicant's violations of federal environmental laws;
- damage to other vehicles using haul route;
- mining method and mining plan;
- adequacy of data used in coal screening process;
- monitoring of impacts;
- mine subsidence;
- impacts on recreational opportunities;
- access to underground coal reserves;
- integration of coal screening process with environmental analysis; and
- energy requirements and conservation potential of alternatives.

The detailed environmental analysis for the proposed lease sale includes an assessment of a No Action Alternative and the Proposed Action, which includes 10 transportation options. The analysis in this EIS assumes that, because 79% of the surface-minable coal within the CBCPA is privately owned, it is highly probable that this coal would be mined even if the federal coal is not leased. Therefore, the No Action Alternative is a "no federal leasing" action rather than a "no mining" action. Surface-mining the federal coal in addition to the private coal would result in incremental increases in environmental consequences. Under the No Action Alternative, underground mining would not be feasible because the privately owned tract is discontinuous (i.e., in a checkerboard mineral ownership pattern) and thus not leasing the federal coal would make the privately owned underground coal uneconomical to mine. BLM would authorize the ROWs needed to facilitate surface mining of the privately owned coal. Because BLM does not have authority over private lands or private coal, this EIS does not analyze a no-mining alternative.

The No Action Alternative also would result in increased effects, over-and-above the effects caused by other existing and proposed developments. The CBCPA and surrounding region are being managed for a variety of uses including livestock grazing, wildlife habitat, windpower development, oil and gas development, municipalities, transportation, transmission (e.g., pipelines and power lines), residential areas, etc., all of which contribute to the existing baseline described in Chapter 3.0 of this EIS. Impacts associated with the additive effects of mining to the existing baseline (which includes lands and other resources that have been impacted by current management) are evaluated in Chapter 4.0, in the discussion of cumulative impacts for each resource.

Under the Proposed Action, BLM would hold a competitive lease sale for surface- and underground-minable federal coal lands. Ark's initial LBA application of September 20, 1996, was modified by BLM on May 15, 1998, to include certain blocks of federal coal not originally applied for and exclude certain blocks due to environmental considerations. Ark subsequently revised their application to include BLM's May 15 modification. BLM may opt to hold the lease sale for surface- and underground-minable coal concurrently or to hold two sales, first for the surface-minable coal and later for the underground-minable coal such that surface mining could be initiated while the BLM's geologic and economic evaluation of the underground reserves is completed. Analysis of the Proposed Action, therefore, includes both leasing options and both the surface (Elk Mountain) and underground (Saddleback Hills) mines.

The EIS analyzes a No Action Alternative project disturbance area of 3,270 acres (see Table 2.2). The Proposed Action (i.e., holding the lease sale) would add up to 1,626 acres of additional disturbance for a total of up to 4,896 acres (up to 50% more disturbance than for the No Action Alternative).

Arch currently provides coal to several local customers located in Laramie, Torrington, and Rawlins, as well as to customers throughout the U.S. Coal for local customers (150,000 tons in 1997) is currently hauled via over-the-road haul trucks directly from the Hanna Basin mines. Development of the new mines would allow these shipments to continue, probably at current levels.

Under the No Action Alternative, mine development would begin in 1999. Surface mining would begin in 2000 and end in 2007. Final reclamation would be completed in 2012; thus the life-of-mine (LOM) would be 13 years. The bonding period would end in 2022, 10 years after final reclamation.

Power to the mine would be supplied via a 115-kV power line from one of two possible connections (see Figure 2.1): 1) Western Area Power Administration's substation near Medicine Bow or 2) PacifiCorp's 230-kV transmission line (currently being constructed to convey power from SeaWest Energy Corporation's windpower generating facility) (BLM 1995a, 1995b, 1997b).

Surface mine (see Figure 2.2) development would include: facilities construction; erection of a dragline and an Archveyor™ (a patented continuous mining machine and conveyor used to access deep but surface-minable coal more efficiently than with surface or underground mining methods) (see Figure 2.3); topsoil salvage; drilling, blasting, and removal of overburden; coal removal and transport; and reclamation. On-site facilities would include: an office complex including administrative offices, changing and lunch rooms, sanitary facilities, and a service building; an equipment-ready area; a maintenance shop; a water pump house; a fuel station; a storage yard; a coal transfer station; a parking lot; a solid waste landfill; the 115-kV power line; substations; and an explosives storage area.

Portions of County Road 215 (see Figure 2.1) would be upgraded to haul road standards and used to access Highway 72. Access to various support facilities (substations, power line, drill sites, monitoring wells, etc.) would be via WDEQ-approved roads within the CBCPA which would be relocated periodically during the LOM. Roads that are no longer needed for mine operations would be reclaimed during interim reclamation.

Arch has proposed to haul coal from the CBCPA north on Highway 72 to the existing Seminoe II loadout (see Figure 2.1) where it would be loaded onto trains. During scoping, BLM received many

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comments concerning the safety hazard presented by hauling coal (up to 436 trips/day) through the town of Hanna. In response to these concerns, Arch; the WDEQ, Abandoned Mine Lands Program (AML); Wyoming Department of Transportation; and Carbon County have initiated plans to construct a two-lane bridge and a 2-mi long road on private land east of Hanna between Highway 30/287 and the end of Highway 72 at Elmo (herein referred to as the Hanna Bypass) (see Figure 2.1). The Hanna Bypass would be a county road and available for public use before, during, and after mining. Funding for the project is being provided by Arch, AML, Wyoming's Industrial Road Project, and Carbon County. The Hanna Bypass is a county project that does not involve any federal lands; therefore, it is included only in the cumulative impacts analysis in this EIS.

Under the No Action Alternative, one mine permit application would be prepared to satisfy WDEQ requirements for baseline analyses of affected resources and detailed mine, reclamation, and mitigation plans. Whereas Chapters 4.0 and 5.0 of this EIS present generalized mitigation measures and performance standards for mine development and operation, the mine permit application would include site-specific mitigation measures (e.g., placement of erosion control devices, location and construction of sediment ponds, drainage retention plans).

Arch proposes to use two surface-mining methods at the Elk Mountain Mine: 1) conventional drilling and blasting combined with a dragline for overburden and coal removal and 2) an Archveyor™ continuous mining machine (see Figure 2.3) for mining coal on exposed highwalls. Approximately 15.05 million tons of coal would be mined using a dragline and 7.40 million tons would be mined using the Archveyor™.

The mining sequence would include: topsoil salvage; overburden drilling, blasting, and removal; and coal drilling, blasting, removal, and transport to a loadout/ coal-handling facility where the coal would be crushed and loaded onto trains for final transport. When the first pit is opened, topsoil and overburden would be salvaged and stockpiled separately, and coal would be removed. As mining progresses, topsoil would be salvaged in advance of the pit, and overburden removed with the dragline would be cast directly into a previously mined area and regraded. Thus, mining and backfilling would become a continuous operation, reducing the need to handle overburden material more than once. Pursuant to the approved reclamation schedule, salvaged topsoil would be replaced on regraded areas, and the area would be revegetated. Where possible, topsoil would be directly backhauled and placed on regraded areas. Large haul trucks (e.g., 200-ton capacity) would haul coal from the pits to transfer stations where it would be loaded onto over-the-road haul trucks.

Once a coal-bearing highwall has been exposed, additional coal would be mined using an Archveyor™ which consists of a modified continuous miner coupled with an articulated traveling conveyor system. The Archveyor™ would be computer-controlled to automatically shear up and down within a coal seam, dumping cut coal onto the conveyor. The conveyor would be approximately 5 ft off the ground and driven by 40 horsepower motors spaced at 24.5-ft intervals. A loadout at the conveyor's terminus would elevate the coal so that it could be loaded into haulage trucks (either over-the-road or 200-ton haul trucks).

Surface mining would begin with a pit in the southwestern portion of the CBCPA, and successive mining passes (i.e., topsoil salvage, overburden removal, and coal removal) would be made parallel to the pit's northern face, so that initial mining would advance in a northeasterly direction (see Figure 2.2). The Archveyor™ would be erected after approximately five passes, after which both mining methods would be employed for the life of the surface mine. The anticipated production rate would be between 1.3 and 3.1 million tons per year.

As part of the mining plan, Arch would leave a 100-ft buffer of unmined land around Second and Third Sand Creeks (see Figure 2.2). The only impact would occur in 2002 when the dragline would be walked from the southwestern to the northeastern portion of the CBCPA during which Third Sand Creek would be crossed twice. At each crossing, a temporary pad, constructed according to WDEQ requirements and composed of gravel, would be placed in the stream channel to provide a relatively level surface for dragline passage. Pad slopes would be stabilized using riprap, netting, or other appropriate material, and sediment fences or other sediment trapping devices would be placed at the base of the pad such that, if a storm occurs while the pad is in place, sediments would not be transported downstream. Pads would be in place no longer than 3-4 days; after the dragline passes, pads would be removed according to a WDEQ-approved plan. The dragline walk road would be reclaimed from 750 ft wide to 200 ft wide and used as a haul road for the remaining LOM. Culverts would be installed where the haul road crosses Third Sand Creek in accordance with the WDEQ-approved mining plan.

Reclamation would be completed throughout the LOM as construction and mined-out areas are no longer required for operations. A detailed reclamation plan, including a reclamation schedule, would be developed for the ROWs and the mine permit pursuant to BLM and WDEQ regulations. Once construction is complete, all disturbed areas not required for operations would be reclaimed. Arch will finish reclaiming the existing Medicine Bow and Seminoe II Mines and then transfer reclamation personnel and equipment to the Elk Mountain Mine. No more than four successive cuts would be made before spoils piles from previous cuts are regraded, topsoiled, and revegetated. When mining is complete, the postmining topography would be restored to the approximate original contour or an approved equivalent. Slopes would be regraded, topsoiled, and revegetated. Facilities, including power lines, would be removed to at least 6.0 inches below ground level and facilities areas would be reclaimed as required by the WDEQ-approved reclamation plan. The final topography would be similar to the premining topography, but postmining slope gradients would be slightly less steep (e.g., 0-12% compared with 0-13%).

Each phase of reclamation (i.e., postconstruction, interim, and final reclamation) would involve the following steps. Spoils would be regraded to a WDEQ-approved postmining topography. Topsoil would be replaced on graded spoils and tilled and treated to prepare the seedbed. Tillage and treatment methods would vary depending on soil type and landscape position, but would probably include ripping, discing, and possible addition of soil amendments. Prepared areas would be seeded with an approved seed mixture, and newly seeded areas would be protected, as appropriate, from wind and water erosion, grazing by livestock and wildlife, and unauthorized traffic using mulches, netting, fencing, signing, or other appropriate methods. Weeds would be controlled according to an approved weed-control program. The detailed reclamation plan would be included in the ROWs and mine permit.

Final reclamation would begin in 2008 and would take approximately 5 years to complete (i.e., 2012).

Under the Proposed Action, BLM would hold a coal lease sale of the LBA tract (see Figure 1.2), subject to coal lease stipulations developed in the Planning Review EA (BLM 1997a) and this EIS. Because the proposed project area is within an area of "checkerboard" landownership (a pattern of alternating sections of federal, state, and private land), the use of federal land is needed for optimal mine development. This EIS analyzes a projected Proposed Action disturbance area of up to 4,896 acres (up to 50% more than under the No Action Alternative) from mining and from power line, railroad, and road corridors outside the LBA tract (see Table 2.2). Surface landownership of disturbed lands would include approximately 4,320 acres of private land, 179 acres of state

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land, and 397 acres of BLM-administered public land.

Surface mining would occur as described for the No Action Alternative with an additional 837 acres (a 26% increase) disturbed because more coal would be surface-mined (see Table 2.2). Underground mine development would occur within the pits created by surface mining. Portals would be constructed using continuous mining machines to cut the main entries to the underground coal. Additional on-site facilities would include an underground longwall mining system. Depending on the transportation option selected, the coal-handling facility, used to load coal into railcars, would be located within the CBCPA or near Medicine Bow. Two additional 115-kV substations would be required to operate underground mine equipment and the coal-handling facility. Once the underground mine is near full production, the existing Seminoe II loadout facility would be disassembled and reclaimed according to Arch's currently approved reclamation plan (Permit No. 377-T4). Facilities and transportation corridor construction (e.g., coal-handling facility, haul roads, a railroad) would create up to 789 acres of additional disturbance, for a total surface disturbance of up to 4,898 acres.

Arch's proposed transportation plan would include 6 years (2000-2005) of hauling coal via the primary haul road west to Highway 72, north on Highway 72 to Hanna Junction, east on Highway 30/287 to the Hanna Bypass, and then north on the Hanna Bypass to the Seminoe II loadout (see Figure 2.1). Concurrent with underground mine development, Arch proposes to construct a railroad between the CBCPA and the Union Pacific Railroad near Medicine Bow (see Figure 2.4), and beginning in 2005, all coal (except for local customers) would be hauled via rail. However, in response to public concern about haul truck traffic on Highway 72, BLM has developed additional transportation options. Selection of one or more transportation options over Arch's proposal to haul coal on Highway 72 for the first 6 years of mining would alleviate the safety hazards and maintenance concerns for Highway 72, but would also have ramifications for other resources such as wildlife, visual resources, air emissions, etc. Any ROWs outside the permit area would include a BLM-approved ROW reclamation plan. Environmental consequences of each option are analyzed as part of the Proposed Action in Chapter 4.0 of this EIS.

As part of the Proposed Action, Arch would prepare a detailed Resource Recovery and Protection Plan (R2P2) for BLM and two mine permit applications for WDEQ. The R2P2 would describe how the proposed operation would meet MLA requirements for diligent development, production, resource recovery and protection (i.e., efficient recovery of the federal coal reserves), continued operation, maximum economic recovery, and the rules of 43 CFR 3480 for the LOM. MLA requires that, before conducting any federal coal development or mining operation on federal coal leases, the operator must submit an R2P2 within 3 years of the effective date of the lease. The lessee is obligated to mine according to the approved R2P2 or face lease suspension or cancellation. Two mine permit applications would be prepared to satisfy Office of Surface Mining (OSM) and WDEQ requirements for baseline analyses of affected resources and detailed mine, reclamation, and mitigation plans.

Under the Proposed Action, the surface mine would be developed and operated as described for the No Action Alternative although more coal would be mined using surface-mining methods. Large trucks (e.g., 200-ton capacity) would haul coal from the pits to transfer stations or coal-handling facilities, depending on the transportation option selected. Of the 34.5 million tons of surface-minable coal, an estimated 31.1 million tons (90%) would be recovered (25% more than for the No Action Alternative). Of the 197.1 million tons of underground-minable coal, 88.02 million tons (45%) would be recovered. The anticipated production rate would be between 1.3 and 7.7 million tons per year.

Underground mining would be performed using a standard longwall mining system which utilizes a shearing device with two rotating drums for cutting coal, a self-propelled hydraulic roof support, and a conveyor to continuously mine coal (see Figure 2.10). During the first year of underground mine development (2003), main entries (the South Mains) would be cut in sec. 34, T.20 N., R.80 W. (see Figure 2.9). During the second year, additional main entries (the East Mains) would be cut in sec. 29, T.21 N., R.79 W. The South and East Mains would intersect underground in sec. 24, T.21 N., R.80 W.

Main entries would be cut using continuous mining machines equipped with rotating drums with bits that cut coal directly from an exposed coal face and load it on to a conveyor or into shuttle cars, which haul it to a conveyor. Main entries would be initiated at the base of the highwalls exposed by surface mining and would follow the Johnson Seam down to approximately 600-800 ft, where most underground mining would occur. The East and South Mains would be approximately 2.0 mi and 3.3 mi long, respectively, and approximately 18 ft wide and 10 ft high, respectively.

The continuous miners would then cut around blocks (referred to as panels) of underground coal (see Figure 2.11). Each panel would be approximately 1,000 ft wide and 10,000 ft long. Once the South and East Mains intersect (in sec. 24, T.21 N., R.80 W.) and the first few panels have been developed, a longwall mining system would be installed at the western end of the southwesternmost panel.

While the continuous miners continue to develop longwall panels, the longwall mining system would mine from the exposed coal face of each panel. The longwall mining system would be equipped with a shearer that has two rotating drums for cutting coal, a self-advancing hydraulic roof support system, and a conveyor to transport coal. The rotating drums would move down and up along the coal face, cutting approximately 18 inches with each pass. The hydraulic roof support system would automatically move towards the receding coal face, and the roof would be allowed to cave into mined-out areas. Cut coal would fall onto a chain conveyor to be transported to a tailgate conveyor and up to the ground surface via the east mains, where it would be temporarily stockpiled in a storage barn. For panels on the western side of the mine, mining would occur from west to east along the coal face. At the end of each pass, the drum and roof support system would be walked back to the western end for another pass. This pattern would be reversed on the eastern side.

The underground mine would be ventilated with exhaust fans along the portals and vertical air shafts located on the South and East Mains.

At the coal-handling facility, raw coal would be dumped into storage barns or a hopper in a crushing building, where the coal would be sized to 2 inches and then conveyed to storage silos or to a tipple equipped with an automatic sampling system and scales. Coal would be loaded into railcars from the tipple. The entire facility would be fully enclosed to minimize fugitive dust emissions.

Estimated production rates for the underground mine would range from 0.3 to 6.6 million tons per year. Total production from combined surface and underground operations would range from 1.3 to 7.7 million tons per year.

Eight additional alternatives were considered but not analyzed in detail.

- Hold a competitive lease sale of other tract configurations to make the LBA tract attractive to other bidders.
- Hold a competitive lease sale for a BLM-preferred tract configuration.
- Postpone competitive lease sale.
- Hold a competitive lease sale for surface-minable coal only (exclude future leasing of underground reserves).
- Hold a competitive lease sale for underground reserves only.

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- Alternative Mining Plans (Resource Protection Alternatives).
- Alternative Mining Methods.
- Upgrade Highway 72 to Four Lanes.

The following critical elements of the human environment would be affected or potentially affected by the No Action Alternative and the Proposed Action: air quality, cultural resources, floodplains, Native American religion concerns, threatened and endangered species, hazardous or solid wastes, water quality, and wetlands/riparian zones. This EIS also discusses the critical elements of environmental justice and wilderness. In addition to critical elements, this EIS discusses potential effects of the proposed project on climate, topography/physiography, geology, minerals, geologic hazards, paleontological resources, water quantity and use, soils and watershed, noise, odor, electric and magnetic fields, vegetation, wildlife and fisheries, socioeconomics, surface ownership and use, and visual resources.

Air quality in the region is generally good (BLM 1995a). The CBCPA is located entirely within the Laramie Air Basin, which is designated as a Prevention of Significant Deterioration (PSD) Class II area under the WDEQ, Air Quality Division (AQD) Implementation Plan (BLM 1987a:152-168). PSD Class II areas are those that may be developed, and the release of limited concentrations of certain pollutants over Class II PSD increments is permitted as long as National Ambient Air Quality Standards are maintained (AQD 1989) and emissions are within the PSD Class II increment. The nearest PSD Class I area (an area where little air quality deterioration is allowed) is the Savage Run Wilderness, located approximately 30 mi south-southwest of the CBCPA. Although the State of Wyoming manages the Savage Run Wilderness as a Class I wilderness, it is not a federally mandated PSD Class I area (i.e., it has not been designated Class I by Congress and thus legally does not have to be managed as a Class I area) (BLM 1995a), and the state is not proposing to apply for a federal Class I designation (personal communication, June 1998, with Darla Potter, WDEQ). Other Class I areas in the region include the Bridger Wilderness in Wyoming and the Mount Zirkel Wilderness in Colorado.

Fugitive dust (uncontrolled wind-carried particles) from natural sources, surface coal mines, highway construction, roads, and other types of development or disturbances (e.g., recreation and livestock grazing) increases the ambient level of suspended particulates in and adjacent to the CBCPA, especially during dry windy periods. Visibility in the region is very good (generally greater than 70 mi), and fine particles are considered to be the main source of visibility degradation.

Air pollutant emissions would be highest in 2005 (see Table 4.2); during this year, no exceedances of National Ambient Air Quality Standards or Wyoming Ambient Air Quality Standards are anticipated at or beyond the CBCPA boundary. This demonstration indicates that during mine operation, pollutant concentrations in ambient air at areas of public access will be within the standards developed by the U.S. Environmental Protection Agency and the WDEQ for the protection of public health. Furthermore, all concentration contributions are smaller than applicable PSD increments. Air quality monitoring stations would be established prior to mine development in accordance with Chapter I, Section 22(j) of the Wyoming Air Quality Standards and Regulations, and air quality would be monitored for the LOM.

The proposed coal mines and transportation corridors would be located primarily in the Carbon Basin, a deep structural and topographic basin composed of 11,000-14,000 ft of sedimentary rocks. The Carbon Basin is separated from the Hanna Basin by a northeast-trending anticline that forms Simpson Ridge. Elevation within the CBCPA ranges from 6,820 ft in the floodplain of Second Sand Creek to 7,660 ft on Simpson Ridge. Relief between plains and ridges is typically less than 200 ft. The landscape is composed of rolling hills, relatively flat floodplains and uplands, deeply dissected valleys, and steep ridges. In the CBCPA, drainage is predominantly to the east-northeast via Third and Second Sand Creeks, which are tributaries to the Medicine Bow River (see Figure 3.4). In the Simpson Ridge vicinity, drainage is to the northeast into First Sand Creek. The transportation corridor areas also ultimately drain into the Medicine Bow River via ephemeral channels, although a small portion of runoff drains into playas with no outlets. The project area is within the Medicine Bow River watershed which is within the North Platte River watershed.

The No Action Alternative and Proposed Action would have widespread, long-term, and permanent effects on topography. During mining, direct impacts to topography would include short- and long-term disruption of the landscape due to pit excavation and the development of a 175- to 200-ft highwall and 100-ft high spoil piles. After reclamation, topography in surface-mined areas (including areas mined with the Archveyor™) would be similar to premine topography, with the exception that the overall landscape would be somewhat flatter and approximately 10 ft lower because coal has been removed. Impacts to topography due to underground mining would include the subsidence of approximately 7,322 acres (257 acres of which would already be affected by surface mining), which would result in a gradual lowering of the landscape. Lowering of the landscape due to coal removal and subsidence would not constitute a significant effect on the human environment, and none of the topographic impacts would violate management objectives.

Coal reserves in the CBCPA are predominantly contained in the Hanna Formation. There are an estimated 34.5 million tons of low-sulphur bituminous surface-minable coal and 197.1 million tons of underground-minable coal within the CBCPA.

Compared with other coal beds, the Johnson Seam (the principal seam proposed for mining), which occurs at the base of the Hanna Formation, is most consistent in quality, distribution, and thickness and thus is the most important seam within the Hanna Formation (Morrison-Knudsen Company, Inc. 1977). In areas proposed for surface-mining, depth of the Johnson Seam ranges from 0 to 200 ft below the ground surface. In areas proposed for underground mining, the Johnson Seam is 200-600 ft underground. Thickness ranges from very thin or absent up to 32 ft and averages approximately 11-12 ft. The Johnson Seam contains few partings, but shaley zones (1.0-2.0 inches thick) are common throughout the seam.

Under the No Action Alternative, removal and eventual combustion of approximately 22.45 million tons of surface-recoverable coal would constitute a significant impact because it is nonrenewable. Approximately 209.15 million tons of surface- and underground-minable (see Table 1.1) coal would be bypassed. This would also constitute a significant impact. Under the Proposed Action, an estimated 119.12 million tons of surface- and underground-recoverable coal would be removed and eventually combusted (431% more than for the No Action Alternative). This would constitute a significant impact because it is nonrenewable. An estimated 112.48 million tons of surface- and underground-minable coal would be bypassed; this would also constitute a significant impact.

Oil, gas, and other mineral exploration and development would be permitted in the CBCPA for the LOM as long as exploration and development would not interfere with coal mine development and operations. The potential for near-future oil and gas development in the CBCPA is slight.

Important paleontological resources on CBCPA (fossils of scientific significance) are not likely to be directly (i.e., destroyed due to mining or Archveyor™ subsidence) or indirectly (i.e., collected by unauthorized personnel) impacted by the project because there is low potential that important paleontological resources occur in the CBCPA. While the formations within the CBCPA are known to contain important fossils elsewhere in the Carbon and Hanna Basins, results of a field survey for fossils showed that there was little potential to encounter important fossils during mine development and operation (Winterfeld 1997); therefore, no significant impacts are anticipated.

As part of the mine permit application, Arch would be required to prepare a detailed soil handling plan (e.g., amount to be salvaged by soil type, locations and volumes of topsoil stockpiles, topsoil stockpile protection measures) and a detailed soil replacement and reclamation plan, including specific soil treatments needed to restore productivity. Because soils would be protected for the LOM and productivity would be restored during reclamation, impacts to soils under the No Action Alternative and the Proposed Action would not be significant.

The normal annual precipitation (12 inches) in the CBCPA vicinity produces approximately 0.13 cubic feet per second (cfs) of runoff per square mile of drainage area. Runoff occurs mainly as a result of summer thunderstorms and rain showers; however, a small portion results from snowmelt (Mesilla Valley Engineers, Inc. 1977). Runoff events are of high intensity and short duration.

The principal drainages within the CBCPA are Second and Third Sand Creeks, which are tributaries of the Medicine Bow River, the only perennial stream in the vicinity (see Figure 3.4). The extreme northwest corner of the project area is drained by First Sand Creek. Second Sand Creek flows east through the CBCPA and intersects the Medicine Bow River approximately 3 mi east of the CBCPA. Third Sand Creek flows southeast and then turns northeast, leaves the CBCPA, and flows 2.5 mi to its confluence with Second Sand Creek. Watershed areas for Second and Third Sand Creeks are 12.0 square (sq) mi and 10.7 sq mi, respectively. The southwestern portion of the CBCPA lies in a closed basin approximately 9.4 sq mi in size.

As part of the permit to mine, Arch would be required to prepare a detailed surface water protection plan which would include provisions for diversions, sediment ponds, channel modifications and restorations, and surface water monitoring. Channel and drainage restoration plans would be included in the WDEQ-approved reclamation plan. Therefore, no significant surface water impacts are anticipated.

The Lewis Shale outcrops around the entire Carbon Basin, with the exception of a small area at the basin's northwestern end, forming a bowl-shaped layer of relatively impervious material and thereby separating the overlying aquifer system from regional aquifers (BLM 1979; Vaughn Hansen Associates, Inc. 1982) (see Figure 3.5). The Lewis Shale almost completely eliminates hydrologic connection between the CBCPA and the Medicine Bow River. Alluvial aquifers along the Medicine Bow River overlie the Lewis Shale and the Medicine Bow Formation but are not in contact with the Hanna Formation.

Impacts to groundwater within the Carbon Basin would include:

- direct groundwater consumption at a rate of up to 126,000 gallons per day;
- indirect groundwater loss due to evaporation;
- temporary loss and permanent alteration of coal and overburden aquifers due to mining and subsidence;
- direct impacts to groundwater users due to groundwater consumption and drawdown in areas adjacent to the proposed mines;
- possible very long-term (thousands of years) reduction in groundwater quality in the replaced overburden aquifer or overburden that is broken during subsidence; and
- accidental temporary pollution caused by unwanted discharges to groundwater.

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Arch would be required to implement a LOM groundwatering monitoring program, and thus impacts to groundwater would not be significant.

Compliance with Mine Safety and Health Administration (MSHA) rules, potential loss of hearing, or increased noise levels that would adversely affect local residents' ability to sleep or perform daily tasks are primary concerns for noise management within the CBCPA and along the transportation corridors. The analyses presented in this EIS show that noise impacts associated with the No Action Alternative and the Proposed Action would not be significant.

Sagebrush shrubland (11,867 acres), mixed shrub/rough breaks (3,508 acres), bottomland shrub (1,346 acres), and grass/subshrub (865 acres) constitute 96% of the total naturally occurring vegetation within the CBCPA (see Table 3.13). Approximately 2% of the total project area was previously disturbed by mining and has been reclaimed or is currently disturbed due to roads, pipelines, and abandoned mines. The remaining land area (2% of the CBCPA) consists of bottomland grasslands, playas, reservoirs/stockponds, greasewood flats, hay meadows, and cottonwood bottoms.

As part of the permit to mine, Arch would be required to prepare a detailed reclamation plan which would include procedures for establishing self-sustaining plant communities and standards for revegetation success. Arch would be required to post a reclamation bond which would not be released until revegetation success standards have been met. Thus, no significant impacts to vegetation would occur under the No Action Alternative or the Proposed Action.

There are more than 30 potential wetlands (approximately 150 acres) within the CBCPA (see Figure 3.4). Most wetlands occur adjacent to the Medicine Bow River (up to 0.5 mi from the main channel) where periodic flooding has caused the development of wetland hydrologic, vegetative, and soils characteristics. Approximately 30 acres of wetlands (impoundments and springs) occur along Second and Third Sand Creeks and are classified as temporarily, seasonally, or semipermanently flooded. Additionally, 23 potential wetlands, most of which are less than 1 acre in size, occur in small depressions and playas throughout the CBCPA.

Arch would be required to develop a wetland mitigation plan, in consultation with WDEQ and the U.S. Army Corps of Engineers, which would be implemented during final reclamation such that wetlands would be restored acre-for-acre (or more) and wetland values and functions (i.e., hydrologic and ecologic characteristics) would be similar to premine conditions. Therefore, impacts to wetlands would not be significant.

The topography, soils, water resources, and vegetation within the CBCPA provide habitats used by numerous wildlife species (see Table 3.15). Four big game mammal species occur on or adjacent to the CBCPA: pronghorn, mule deer, white-tailed deer, and elk. An additional 67 mammal species are known to occur or are likely to occur in the vicinity of the CBCPA. Predator species known to occur or potentially occurring in the area are coyote, red fox, swift fox, gray fox, black bear, raccoon, ermine, long-tailed weasel, black-footed ferret, mink, badger, western spotted skunk, striped skunk, mountain lion, and bobcat (Clark and Stromberg 1987; TRC Mariah Associates Inc. [TRC Mariah] 1995; Intermountain Resources 1997; Luce et al. 1997). Lagomorph species include desert cottontail, mountain cottontail, black-tailed jackrabbit, and white-tailed jackrabbit (Clark and Stromberg 1987; TRC Mariah 1995; Intermountain Resources 1997; Luce et al. 1997). Sciurids (i.e., squirrels) known to occur or potentially occurring within the CBCPA include yellow pine, least, and Uinta chipmunks; yellow-bellied marmot; Wyoming, thirteen-lined, and golden-mantled ground squirrels; white-tailed prairie dog; and eastern fox and red squirrels (Clark and Stromberg 1987; TRC Mariah 1995; Intermountain Resources 1997; Luce et al. 1997).

Other rodents in the area include northern pocket gopher, olive-backed and silky pocket mice, Ord's kangaroo rat, beaver, western harvest mouse, deer mouse, white-footed mouse, northern grasshopper mouse, bushy-tailed woodrat, several species of voles (i.e., southern red-backed, heather, montane, long-tailed, prairie, and sagebrush), muskrat, western jumping mouse, and porcupine. Several species of shrews (i.e., masked, pygmy, dusky, dwarf, water, and Merriam's) and bats (i.e., pallid bat, little brown myotis, long-legged myotis, fringed myotis, small-footed myotis, Townsend's pale big-eared bat, big brown bat, and hoary bat) also are known to occur or may occur on the CBCPA (Clark and Stromberg 1987; personal communication, August 15, 1997, with Bob Luce, Nongame Biologist, Wyoming Game and Fish Department [WGFD]) (Appendix A).

The entire CBCPA is considered suitable habitat for raptor hunting, foraging, and perching. Raptor species observed within or adjacent to the CBCPA include turkey vulture, osprey, bald eagle, northern harrier, sharp-shinned hawk, northern goshawk, broad-winged hawk, Swainson's hawk, red-tailed hawk, ferruginous hawk, rough-legged hawk, golden eagle, American kestrel, merlin, peregrine falcon, prairie falcon, great horned owl, western burrowing owl, short-eared owl, and northern saw-whet owl (TRC Mariah 1995; Intermountain Resources 1997; WGFD 1997b). Other raptor species potentially occurring within or adjacent to the CBCPA are Cooper's hawk, barn owl, and long-eared owl (Scott 1987; Russell 1990; WGFD 1994; TRC Mariah 1995; Luce et al. 1997). Most breeding species in the area migrate south to more hospitable climates during the winter; however, golden eagles, bald eagles, and great horned owls remain year-round. Rough-legged hawks move into the CBCPA during the winter and migrate north during the breeding season. Peregrine falcons have been observed hunting adjacent to the CBCPA (TRC Mariah 1995).

One hundred seventy-five intact raptor nests were located within the 59,225-acre (94-mi^2) wildlife survey area in 1997 (see Table 3.16), for a total density of 1.86 nests per mi^2 and 0.32 active nest per mi^2 (Intermountain Resources 1997).

Two species of upland game birds--sage grouse and mourning dove--and approximately 148 passerine species occur within the CBCPA. The mourning dove is a common breeding bird in the CBCPA, and a number of waterfowl species have been observed on the various impoundments, reservoirs, and perennial creeks and rivers within and immediately adjacent to the area.

Five threatened, endangered, or candidate (TE&C) wildlife species have been documented or potentially occur on the CBCPA (black-footed ferret, bald eagle, peregrine falcon, mountain plover, and swift fox) (see Table 3.18). Thirty-six additional U.S. Fish and Wildlife Service (USFWS) and/or Wyoming state species of concern occur or potentially occur in the CBCPA.

The EIS analysis shows that the proposed mine(s) would result in locally significant impacts for crucial winter range and overlapping crucial winter ranges for pronghorn and mule deer and for sage grouse strutting grounds and breeding habitat where habitat is removed; however, with mitigation, mine development and operation should not have a significant impact at the regional population level and management objectives would be met for all wildlife resources. Direct avian mortality due to collisions with vehicles, power lines, etc., would constitute an illegal take under the *Endangered Species Act*, the *Migratory Bird Treaty Act*, and/or the *Bald Eagle Protection Act*, depending on the affected species and would constitute a significant impact.

A total of 160 cultural resources sites has been recorded within the CBCPA; 114 sites are prehistoric, 37 are historic, and nine are multicomponent--containing both prehistoric and historic resources. Sites recommended as eligible for nomination to the National Register of Historic Places (NRHP) include the Johnson, Kent, Black Diamond, and Richardson Mines and the Johnson

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winter ranch headquarters, and four of the multicomponent sites have components that are recommended as potentially eligible. The remaining sites are recommended as not eligible.

All eligible sites would either be avoided or otherwise mitigated via an agency-approved data recovery program. At the time of draft EIS preparation, the Class III inventory report was in preparation, and it was not known which sites the agencies (BLM, State Historic Preservation Office [SHPO], LQD, and OSM) would designate as eligible. Agency determination of eligibility would be required prior to implementing a testing program to determine the significance of potentially eligible sites. Native American consultation will be conducted to determine NRHP eligibility of sites important to Native Americans. With mitigation and monitoring, mine development and operation would not cause significant impacts to cultural resources.

Mine development and operation would continue employment opportunities for workers now employed at Arch's Medicine Bow and Seminoe II surface coal mines, both of which will likely be mined out by the year 2000. Continued or increased employment would be beneficial.

Communities within Carbon County, entities with interests in the area, and individuals with ties to the area all have concerns about the presence of coal mine(s) in the area. With regards to environmental justice issues affecting Native American tribes or groups, the CBCPA contains no tribal lands or Native American communities, and no treaty rights or Native American trust resources are known to exist for this area.

There could be a 1,140% increase in truck traffic depending on the leasing alternative and transportation options selected (see Table 4.17). Traffic volume (up to 914 vehicles per day) could exceed Highway 72 design standards (744 vehicles per day). Arch is currently negotiating with the Wyoming Department of Transportation to develop mitigation for this impact which, without mitigation, would be significant. Loss of life and property due to accidents would also constitute a significant impact. The increased traffic volume would increase the likelihood of traffic accidents, especially at intersections such as the junction of Highway 72 and 30/287 where haul trucks returning to the mine would have to make a left-hand turn across traffic. No other impacts would be significant because no violations of Wyoming Department of Transportation regulations would occur.

Major land uses within and adjacent to the project area are agriculture (primarily cattle and sheep grazing); wildlife habitat; dispersed outdoor recreation (e.g., hunting, hiking, camping, wildlife observation, nature photography, and off-road vehicle use); and oil and natural gas exploration, development, and transportation. Mining was a previous land use, as exhibited by the numerous abandoned mines in the CBCPA.

Surveys of Carbon County residents conducted recently as part of the development of a Carbon County land use plan suggested a need to balance the conservation of natural resources and the economic viability of resource-based industries in the county; however, commercial mining activities were viewed favorably by 54% of those responding to the question (Pedersen Planning Consultants 1997). The Carbon County Land Use Plan (Pedersen Planning Consultants 1997) recommends that areas in the county suitable for surface or underground coal mining be designated to accommodate those uses.

The CBCPA and most of the transportation corridors are within a Visual Resource Management (VRM) Class III area. The northwestern portion of corridors B-1, B-2, B-3, C-1, and C-2 are within a VRM Class IV area. VRM objectives for Class III areas allow moderate changes to the existing landscape, but management activities associated with these changes should not dominate the view of the casual observer and changes should repeat the basic elements of the characteristic landscape. VRM objectives for

Class IV areas allow changes that may subordinate the original composition and character, but reflect what could be a natural occurrence in the landscape.

There has been little development within the CBCPA and along the transportation corridors such that the natural visual quality is relatively undisturbed. Existing developments that currently affect visual quality include roads, pipelines, telecommunications lines, power lines, mines, PacifiCorp's 230-kV transmission line, and oil and gas development. At the northern ends of the transportation corridors, other developments such as the towns of Hanna and Medicine Bow, the Seminoe II Mine, Miner's Substation, and Highway 30/287 affect existing visual quality.

Topography would screen the mine for all but 0.5 mi along Interstate 80 (I-80) and 1.0 mi along Highway 72 (see Figure 4.8); therefore, the dragline and spoil piles would be visible for 0.5-1.0 minute off to the viewer's side and thus is not likely to dominate the view of a casual observer. Furthermore, most motorists in this area would be looking at Elk Mountain, which is a strikingly scenic feature and on the opposite side of I-80 and thus would draw attention away from the mine. If the spoils and dragline were viewed head-on for several minutes, the mine would dominate the view, but given the circumstances along I-80 and Highway 72 in the mine area, impacts are not expected to be significant. For off-highway viewers (e.g., travelers on County Road 3, ranchers, recreationists, etc.) in the mine vicinity, the mine would dominate the landscape and thus would significantly impact visual quality. However, the number of viewers would be relatively few.

Arch evaluated potential hazardous wastes within the CBCPA using existing sources of information. The area was found to be free from obvious environmental degradation within the scope of the hazardous substances and petroleum products identified in the *Comprehensive Environmental Response, Compensation, and Liability Act of 1920*. Potential sources of future contamination would include:

- spilling, leaking, and/or dumping of hazardous substances, and/or petroleum products associated with mineral, coal, oil, and/or gas exploration and development and agricultural and livestock activities and
- other sources of contamination not currently obvious or identifiable.

The small amount of soil that potentially could be contaminated, coupled with appropriate and timely cleanup, would result in negligible potential soil impacts from accidental spills. Proper containment of oil and fuel in storage areas and location of facilities away from drainages would limit potential surface and groundwater contamination and preclude any possible wildlife exposure.

Since project operations would comply with all relevant federal and state laws regarding hazardous materials and with directives identified in the Hazardous Materials Management Plan and the Spill Prevention, Control, and Countermeasures Plan for this project, no significant impact is anticipated.

The primary irreversible and irretrievable commitment of resources would include labor, materials, and energy expended during mine development, operation, and reclamation; coal mining and eventual combustion; groundwater consumption by mine equipment and loss via evaporation; surface water loss via evaporation; soil loss through wind and water erosion; loss of productivity (i.e., forage, wildlife habitat) from lands devoted to project activities during the time those lands are out of production and until they are successfully revegetated; inadvertent destruction of paleontological or cultural resources; and accidental animal mortality as discussed in the impact analysis in Chapter 4.0.

LOM fuel consumption under the No Action Alternative would be an estimated 12.71 million

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gallons for mining and reclamation plus an additional 4.87 million gallons for over-the-road coal haulage (see Table 4.18). Under the Proposed Action, LOM fuel consumption would be an estimated 40.63 million gallons (a 27.92 million gallon [220%] increase over the No Action Alternative) for mining and reclamation plus an additional 0-33.29 million gallons per year depending on the transportation alternative selected.

Under the No Action Alternative, an estimated 138.00 million kilowatt hours (kwh) would be required over the LOM (see Table 4.19). Electricity consumption would be greatest between 2001 to 2007 (approximately 16.20 million kwh/yr). The dragline, estimated to consume 0.7 million kwh/month, would be the greatest consumer of electricity under the No Action Alternative. Electricity consumption for the Archveyor™ (2001-2010) would be approximately 0.3 million kwh/month. Loadout facilities are estimated to consume 0.15 million kwh/month (1.8 million kwh/yr), and general support facilities are estimated to use 0.2 million kwh/month.

Under the Proposed Action, approximately 354.00 million kwh would be consumed over the LOM (216.00 million kwh more [a 157% increase] than for the No Action Alternative). Consumption at the mine (i.e., excluding transportation options) would be highest between 2005 and 2010 when an estimated 24.00 million kwh/month would be used. Electricity consumption rates for the longwall mining system (2005-2020) and the continuous miners (2004-2020) would be approximately 0.40 million and 0.25 million kwh/month, respectively.

Only the conveyor transportation option (options 7, 8, and 10) uses additional electricity, over-and-above the amount required for the Proposed Action. Under options 7 and 8, an additional 155.52 million kwh would be consumed; under option 10, an additional 544.32 million kwh would be consumed.

Chapter 5.0 in this EIS reproduces, in their entirety, WDEQ's performance standards for surface and underground mines and BLM's mitigation guidelines. These standards and guidelines were developed specifically for the purpose of environmental protection, and Arch would be required to comply with all of the applicable requirements. These regulations and guidelines have been reproduced because they provide the details of mitigation and monitoring required for this project but they may not be readily available to the public or other EIS reviewers for whom proposed mitigations must be fully disclosed. The environmental analysis presented in Chapter 4.0 assumes that these mitigation measures would be successfully implemented for the LOM.

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1.0 INTRODUCTION

Ark Land Company (Ark), St. Louis, Missouri, has filed a lease-by-application (LBA) with the U.S. Bureau of Land Management (BLM), Wyoming State Office, to obtain a federal coal lease (WYW 139975) pursuant to provisions found at 43 Code of Federal Regulations (CFR) 3425.1. The proposed lease area is located in the Carbon Basin, Wyoming, within the BLM's Great Divide Resource Area (GDRA) approximately 3 miles (mi) north and northeast of Elk Mountain and 10 mi southeast of Hanna, Wyoming (Figure 1.1), on a mixture of federal, state, and private surface ownership; coal ownership is also mixed (Table 1.1). Ark owns some of the surface and has obtained rights from other surface owners to access state and private land.

The Carbon Basin Coal Project Area (CBCPA) (Figures 1.1 and 1.2) encompasses 18,360 acres. The CBCPA boundary encompasses the area for which Arch of Wyoming, LLC (Arch), an affiliate of Ark, will apply for permits to mine from the State of Wyoming and was determined by Arch based on surface landownership patterns and coal distribution. The LBA area (Figure 1.2) encompasses 5,235.15 acres of federal mineral estate located in 11 discontinuous parcels interspersed through private and state lands and contains approximately 149.7 million tons of federal coal (Figures 1.2 and 1.3, Tables 1.1 and 1.2). A more precise estimate of minable reserves in the federal tract, based on detailed geological and engineering evaluations, would be included in the tract sale notice.

The federal coal, which makes up approximately 39% of the total estimated reserve (Table 1.1), would be combined with state and private holdings to develop a feasible mining unit. If BLM decides not to lease the federal coal on these 5,235.15 acres to Ark, the private and state holdings would likely be surface mined, and the federal surface-minable coal would be bypassed. If not mined at this time, it is unlikely that federal surface-minable coal would be leased or mined in the future because the federal coal lands are too discontinuous to form a feasible mining unit. Furthermore, if the federal coal is not leased, underground mining of private and state coal would not be economically feasible at this time. The federal underground-minable coal could be leased at a later date and mined in conjunction with private and state underground-minable coal, so not leasing the underground-minable coal at this time would not preclude its future recovery.

The LBA process is, by law, an open, public, competitive, sealed-bid process whereupon the coal lease is granted to the highest bidder. Although a company other than Ark could possibly be granted a lease, the analysis presented in this environmental impact statement (EIS) is based on the assumption that Ark, as the owner of much of the surrounding coal, would be the successful bidder and Arch, an affiliate of Ark, would mine the coal. Both Ark and Arch are owned by Arch Coal, Inc. In the unlikely event that another company is the qualified bidder on the LBA tract, the lease would not be issued until additional environmental analysis is completed.

To process an LBA, BLM must evaluate the quantity, quality, maximum economic recovery, and fair market value of the federal coal and fulfill the requirement of the *National Environmental Policy Act of 1969* (NEPA). This EIS is intended to provide both the public and agency decisionmakers with a complete and objective evaluation of impacts likely to result from the Proposed Action (the leasing of 5,235.15 acres) and its reasonable alternatives and was prepared in compliance with the NEPA and applicable regulations and laws passed subsequent to NEPA, including Council on Environmental Quality (CEQ) regulations (40 CFR, Part 1500-1508); U.S. Department of the Interior (USDI) guidelines in *Departmental Manual 516, Environmental Quality* (USDI 1980); guidelines listed in the BLM *NEPA Handbook, H-1790-1* (BLM 1988); BLM's desktop reference *Overview of BLM's NEPA*

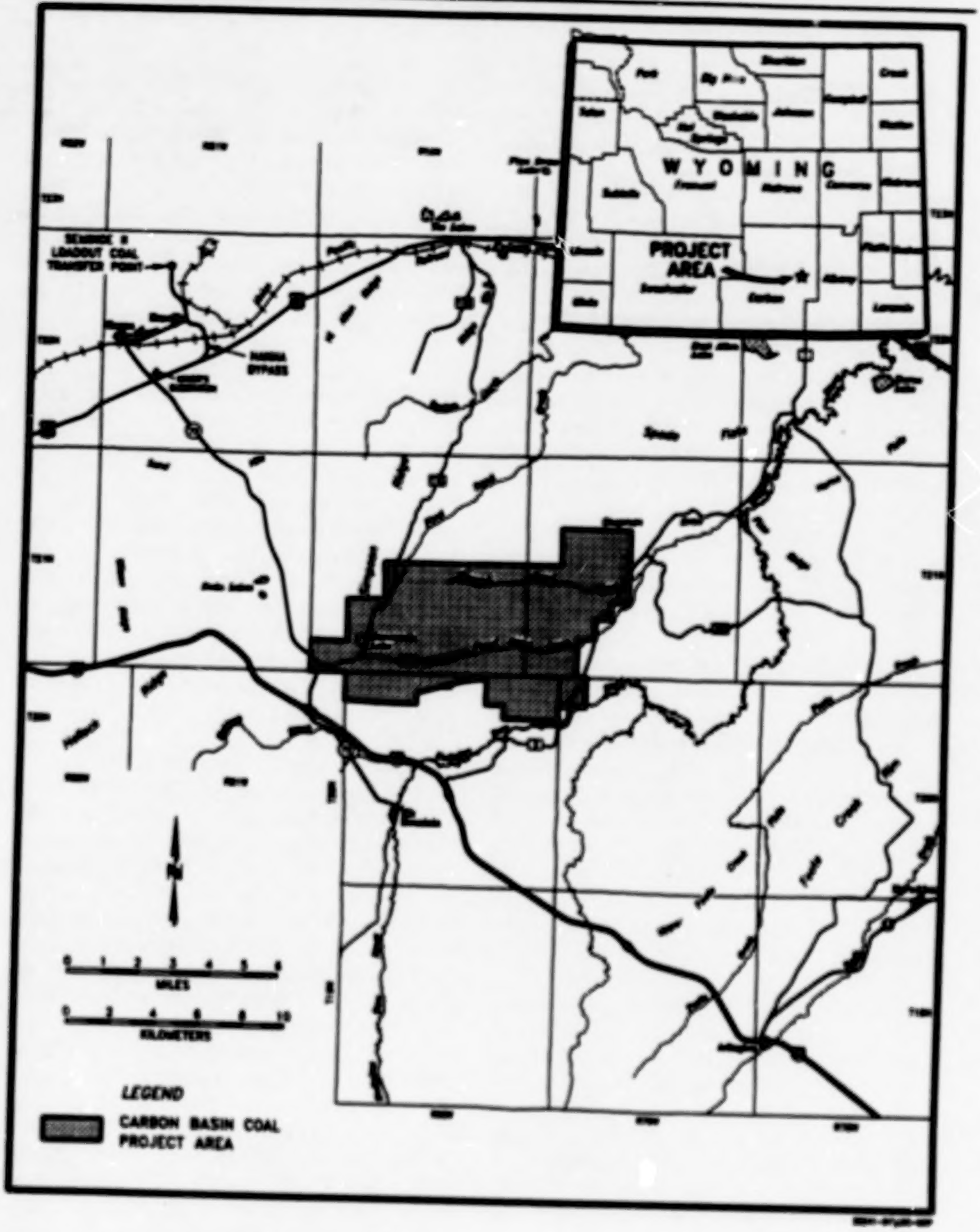

Figure 1.1 Carbon Basin Coal Project Area.

Table 1.1 Coal and Surface Ownership Within the CBCPA.[1]

	Coal Ownership (million tons)			
	In Place		Surface-Minable	
Owner	Total	%	Total	%
Federal	149.7	39	6.0	17
State	5.2	1	1.2	3
Private	230.7	60	27.3	79
Total	385.6	--	34.5	--

	Coal Ownership (million tons)			
	Underground-Minable		Total Minable	
Owner	Total	%	Total	%
Federal	88.0	45	94.0	41
State	0.3	0	1.5	1
Private	108.8	55	136.1	59
Total	197.1	--	231.6	--

	Surface Ownership (acres)	
Owner	Within Project Area	% of Total
Federal	3,266[2]	18
State	1,445	8
Private	13,649	74
Total	18,360	--

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[1] Private coal owners include Ark Land Company, Union Pacific Resources Company, Darlene Herman, and R.M. Eckerson et al. Private surface owners include Ark Land Company, Gerald and Nancy Palm, and Robert Scherer. No surface disturbance would occur on surface lands owned by Robert Scherer.

[2] This is the acreage of federally owned surface lands. Federal coal lands, which include all of the surface ownership that overlie federally owned coal, total 5,235.15 acres.

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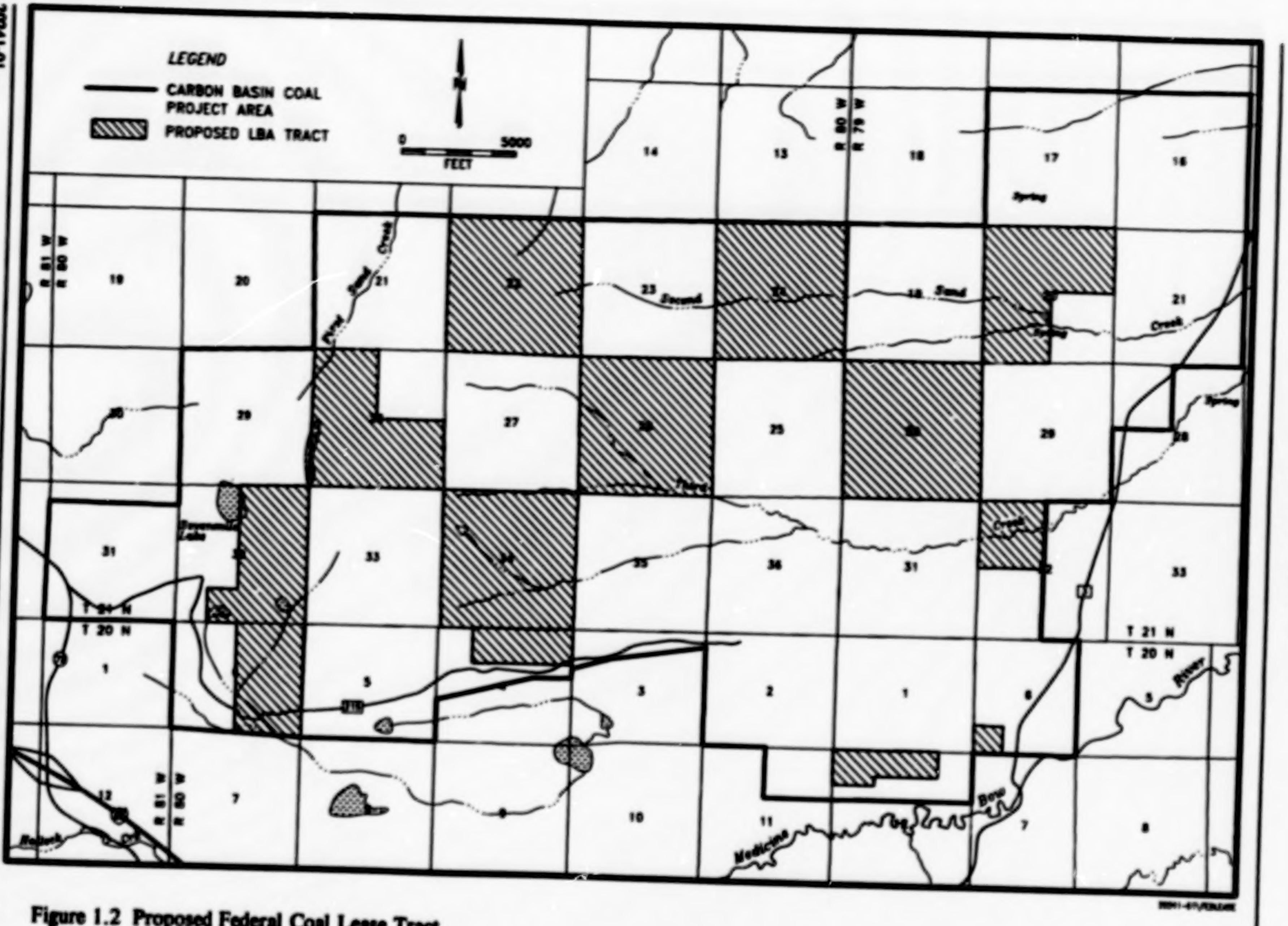

Figure 1.2 Proposed Federal Coal Lease Tract.

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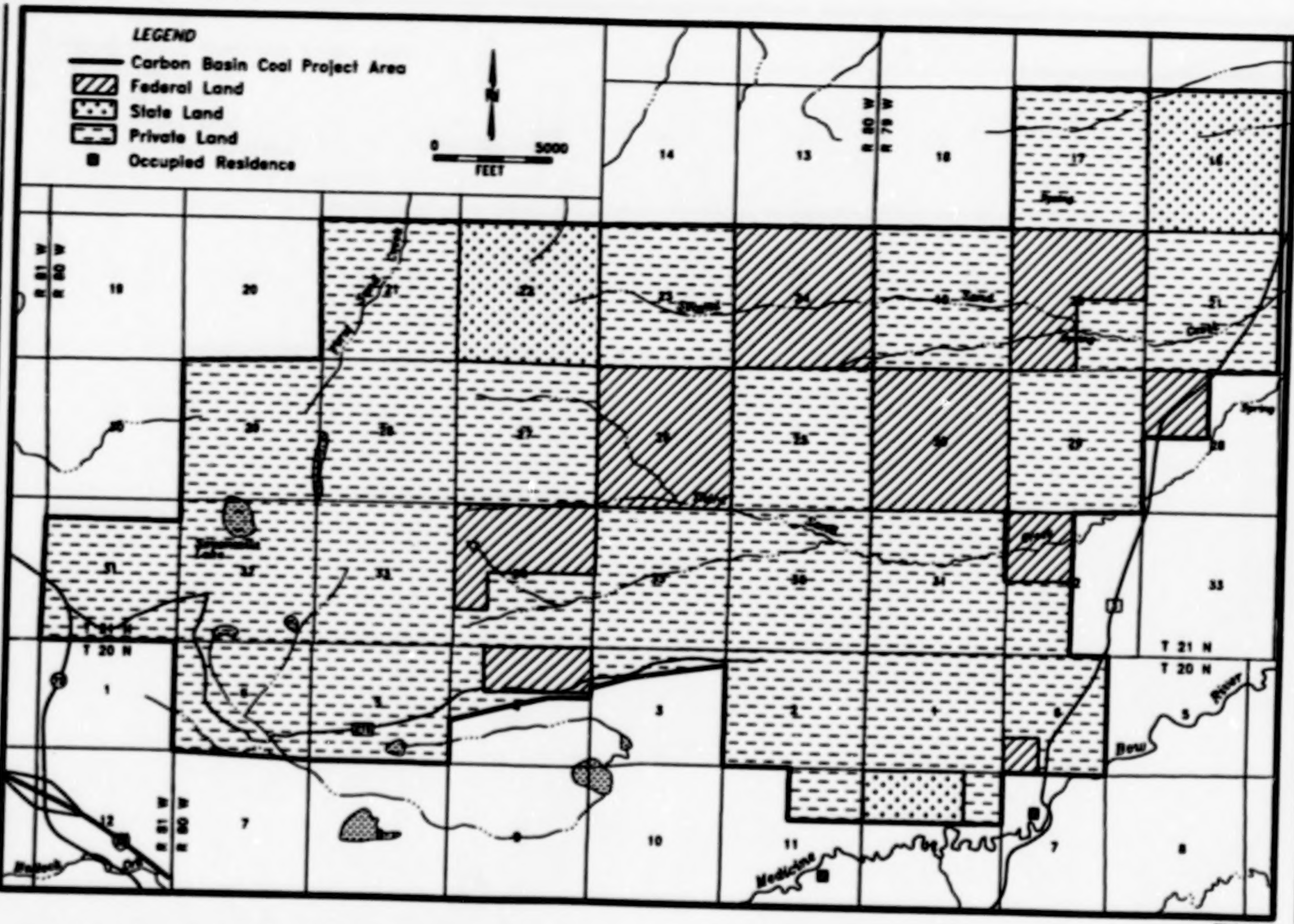

Figure 1.3 Surface Landownership Within the CBCPA.

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Table 1.2 Proposed LBA Tract.

Legal Description[1]	Acreage[2]
T.20 N., R.79 W.	
sec. 6, lot 5	46.15
T.20 N., R.80 W.	
sec. 4, lots 1, 2, and 3	164.64
sec. 6, lots 1 and 2 and SE¼	259.47
sec. 12, N½NW¼NE¼, N½NE¼NW¼, SW¼NE¼NW¼, NW¼NW¼	90.00
T.21 N., R.79 W.	
sec. 20, N½ and SW¼	480.00
sec. 30, lots 1, 2, 3, 4; E½; and E½W½	634.89
sec. 32, NW¼	160.00
T.21 N., R.80 W.	
sec. 22, all	640.00
sec. 24, all	640.00
sec. 26, all	640.00
sec. 28, W½ & SE¼	480.00
sec. 32, E½ and SE¼SW¼	360.00
sec. 34, all	640.00
Total	5,235.15

[1] Sixth Principal Meridian, Carbon County, Wyoming.

[2] Acres of federal mineral estate.

Process (BLM 1996); and *BLM Guidelines for Analyzing and Documenting Cumulative Impacts* (BLM 1994a).

1.1 PURPOSE AND NEED

The federal government maintains a policy to encourage private industry in the economically sound and orderly development and mining of domestic reserves, and the Secretary of the Interior has responsibility to carry out this policy. Since the passage of the *Mineral Leasing Act of 1920*, as amended (MLA), the USDI, through its implementing agency the BLM, has been charged with administering a leasing program that would allow the private sector to mine federally owned coal reserves. Furthermore, pursuant to the *Mining and Minerals Policy Act of 1970*, "it is the continuing policy of the Federal Government in the national interest to foster and encourage private enterprise in 1) the development of economically sound and stable domestic mining, minerals ... industries, 2) the orderly and economic development of domestic mineral resources, reserves ... to help assure satisfaction of industrial, security, and environmental needs."

Ark proposes to obtain a federal coal lease on 5,235.15 acres for surface- and underground-minable coal, which would grant Ark the exclusive right to obtain mining permits for, and to mine, coal on the leased tract (Figure 1.2). Arch would develop and operate two mines: the Elk Mountain Mine for surface-minable coal and the Saddleback Hills Mine for underground-minable coal. Mining operations would be subject to the terms of the lease, the mine permits (two state permits would be required--one each for the surface and underground mines), federal mining plan approval, and other applicable state and federal laws and regulations. Arch presently operates two surface coal mines (Medicine Bow and Seminoe II) in the vicinity of Hanna, and issuance of the new coal lease in the Carbon Basin would enable Arch to extend the life of mining operations in the area by 20 years and to continue supplying coal to existing customers, as well as to develop new contracts.

Ark currently has 93,700,000 tons of coal leased at the Seminoe II and Medicine Bow Mines in the Hanna Basin north of the CBCPA (see Figure 4.1), 70,000,000 tons of which have been mined. Current reserves are estimated at 23,700,000 tons, 3,100,000 tons of which are economically recoverable reserves and will be depleted by 2000 at current production rates. Without supplemental reserves, no additional coal will be available for Arch to meet electric utility demands for low-sulfur coal to provide the U.S. with electrical power and to comply with the *Clean Air Act* and amendments.

The primary federal action associated with the Proposed Action would be to hold a lease sale for the 5,235.15 acres of federal coal lands in the project area. For the purposes of this EIS, 10 transportation options (e.g., over-the-highway haulage, railroad, new haul road haulage, conveyor) were developed to transport coal from the CBCPA north to the Union Pacific Railroad mainline. Access to federal land for the construction, operation, and reclamation of any of the transportation corridors would be authorized by BLM through the issuance of rights-of-way (ROWs), an action that would also require NEPA analysis. The environmental consequences of constructing, operating, and reclaiming each of the transportation options are evaluated in this EIS, such that, if Arch applies for a ROW grant that is analyzed herein, BLM may issue the ROW grant using an Administrative Determination that references this EIS for NEPA compliance. If Arch's application differs to a degree that is not deemed to have been adequately treated in this EIS, BLM may opt to supplement the EIS prior to making a decision on whether or not to issue the ROW. The Record of Decision for this project will include a decision on whether or not to lease the LBA tract as described for the Proposed Action, a decision on all stipulations to be added to any coal lease, and a list of transportation options that BLM deems acceptable for ROW grant issuance. These transportation options would then be evaluated by Arch and Wyoming Department of Environmental Quality (WDEQ) during the permitting process. If BLM determines that one or more of the options are environmentally unacceptable, the unacceptable options will be stricken from the Proposed Action as described in the Record of Decision and these options would not be available to Arch. The analysis assumes that BLM would grant the necessary ROWs. If federal coal is not leased, BLM would grant the ROWs needed to facilitate mining the privately owned coal.

The public will be able to comment on the transportation options during review of the draft and final EISs, during development of the mine permit (WDEQ has built-in public comment periods), and when BLM issues any ROWs. Therefore, as Arch finalizes plans for mine development, there will be several opportunities for public comment on the proposed coal transportation plan. If a completely new transportation plan is developed and a BLM ROW is required, additional NEPA documentation will be required and will include public involvement pursuant to NEPA.

1.2 CONFORMANCE WITH LAND USE PLANS

The leasing of federal coal is an integral part of the BLM Federal Coal Management Program of 1979 under authority of the MLA, the *Federal Land Policy and Management Act of 1976* (FLPMA), and *Federal Coal Leasing Amendments Act* (FCLAA). FCLAA requires that lands considered for leasing be included in a comprehensive land use plan. In 1982, a federal coal lease was issued for approximately 60% of the federal coal lands located in the Carbon Basin. Because that lease was still in effect at the time the RMP was prepared (BLM 1990), it was exempt from the coal screening/planning requirements, and therefore, there was no coal planning decision for federal coal lands in the Carbon Basin area included in the RMP. This lease was never developed and expired in 1992. Therefore, when Ark submitted their coal lease application, the application was not in conformance with the existing land use plan. An RMP review was conducted by BLM in 1997/98 (*Environmental Assessment for Coal Planning Decisions in the Carbon Basin Area of the Great Divide Resource Area* [Planning Review EA]) (BLM 1997a), and the decision was made to designate the area as acceptable for further consideration for coal leasing and development. The Federal Coal Management Program of 1979 established four major steps--referred to as the coal screening process--to be used in the identification of federal coal areas acceptable for coal development. The process includes:

- identification of coal development potential, including coal resource information (43 CFR 3420.1-2);
- application of the coal unsuitability criteria (43 CFR 3461);
- multiple use conflict evaluation (43 CFR 3420.1-4(e)(3); and
- surface owner consultation.

Only those federal coal lands found acceptable for coal development by the screening process are given further consideration for leasing.

During the RMP planning review and preparation of the EA described above, these four steps were applied to lands that include the proposed project area. These lands were found acceptable, and the RMP was amended to identify those areas in the Carbon Basin as open to consideration for coal leasing and development. The proposed lease area represents 35% of the leasable area in the Carbon Basin. Details of the screening process and results are included in the Planning Review EA (BLM 1997a).

BLM initially proposed to prepare one document that addressed both the RMP amendment and the proposed mines. In January 1997, BLM decided to prepare two NEPA documents, the Planning Amendment EA and this EIS that addresses the site-specific effects of coal leasing and mine development and operation. This EIS is tiered to the GDRA RMP, as amended, and thus does not reiterate the coal screening process. Public comments on the Planning Review EA apply to the planning process rather than mine development, and therefore, they are not included here.

1.3 RELATIONSHIP TO EXISTING REGULATIONS, POLICIES, AND PLANS

BLM is the lead agency responsible for leasing federal coal lands under the MLA, as amended by FCLAA, which allows the private sector to mine federally owned coal reserves. A federal coal lease grants the lessee the exclusive right to obtain a mining permit for, and to mine coal on, the leased tract subject to the terms of the lease, the mine permit, and applicable state and federal laws. In return for receiving a lease, the lessee must make a bonus payment to the federal government when the coal is leased, make annual rental payments to the federal government, and make royalty payments to the federal government when the coal is mined.

The leasing program allows for the designation of new production tracts (a lease to open a new mine), bypass tracts (a lease needed to prevent leaving islands of unmined coal), and maintenance tracts (a lease needed to continue operations at an existing mine). Although the proposed mines would be developed to extend the life of operations at the Seminoe II Mine, the lease area is sufficiently distant from Hanna to warrant treating the LBA as an application for a new production tract. The leasing program also provides for leasing of federal coal to ensure that adequate coal supplies are available to meet long-term national energy requirements and that sufficient reserves are available to continue existing production and meet lessees' contractual obligations.

The Elk Mountain/Saddleback Hills LBA is located within the Green River-Hams Fork Coal Region. The Regional Coal Team for this area has not met since the region was decertified in 1988 (*Federal Register Notice*, Thursday, April 21, 1988).

The Office of Surface Mining (OSM) is a cooperating agency on this EIS. After a coal lease is issued, the *Surface Mining Control and Reclamation Act* (SMCRA) gives OSM primary responsibility to administer programs that regulate surface coal mining operations and surface effects of underground coal mining. Pursuant to Section 503 of SMCRA, WDEQ developed, and in November 1980 the Secretary of the Interior approved, a permanent program authorizing WDEQ to regulate surface coal mining operations and surface effects of underground mining on nonfederal lands within the State of Wyoming. In January 1987, pursuant to Section 523(c) of SMCRA, WDEQ entered into a cooperative agreement with the Secretary of the Interior authorizing WDEQ to regulate surface coal mining operations and surface effects of underground mining on federal lands within the state.

Pursuant to the cooperative agreement, a federal coal lease holder in Wyoming must submit a permit application package to OSM and WDEQ for any proposed coal mining and reclamation operation on lands within the state. WDEQ reviews the permit application package to ensure that it complies with the permitting requirements and that the coal mining operation will meet the performance standards of the approved Wyoming program. OSM, BLM, and other federal agencies review the permit application package to ensure that it complies with the terms of the coal lease, the MLA, NEPA, and other federal laws and their attendant regulations. If the permit application does comply, WDEQ issues the applicant a permit to conduct coal mining operations. OSM recommends approval, approval with conditions, or disapproval of the mining plan to the Assistant Secretary of the Interior, Land and Minerals Management. Before the mining plan can be approved, the BLM must concur with this recommendation.

As part of the permitting process, a new mine and reclamation plan would be developed to show how lands in the LBA and private- and state-owned coal would be mined and reclaimed. Specific

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impacts that would occur during mining would be addressed in the mine permit, and specific mitigation measures for anticipated impacts would be identified at that time.

WDEQ enforces the performance standards and permit requirements for reclamation during a mine's operation and has primary authority in environmental emergencies. OSM retains oversight responsibility for this enforcement. BLM has authority in those emergency situations where WDEQ or OSM cannot act before environmental harm and damage occurs.

Table 1.3 lists the authorizing actions required for project compliance with federal, state, and local laws. In addition to this EIS and associated decision documents, BLM would issue a coal lease to mine federal coal and ROW grants to develop mine facilities (e.g., power lines) on federal lands.

Arch is proposing to develop the surface mine beginning in 1999, thereby continuing its operations in Carbon County with little or no suspension. Arch plans to permit the surface mine first and later apply for the underground mine permit. Because there would be two permits (one each for the Elk Mountain and Saddleback Mines) there would also be two ***permit*** areas, both of which would lie within the ***project*** area boundary (the CBCPA) discussed in this document. The distinction between the ***permit*** areas and ***project*** area is important because, once the coal is leased, WDEQ has primary responsibility for any and all facilities within the permit areas and for any permitted facilities outside the permit area (e.g., coal-handling facility, railroad) (Table 1.4). BLM would authorize new roads, power lines, and other facilities located outside the permit area on federal land via ROW grants. Although the mines would be permitted separately, both mines are addressed in this EIS.

This project would conform to management directions specified for leasable minerals development in the GDRA RMP as amended (BLM 1990) and will incorporate, by reference, management prescriptions that have been specified in those documents, as well as in the Planning Review EA (BLM 1997a).

The proposed mine would be operated in accordance with Mine Safety and Health Administration (MSHA) rules and regulations. Explosive material would be handled in accordance with the laws and regulations administered by MSHA and the Bureau of Alcohol, Tobacco, and Firearms.

1.4 PUBLIC PARTICIPATION AND CONSULTATION

On November 18, 1996, BLM filed a public notice announcing that this coal lease application had been received and requested public comment. A notice was published in the *Federal Register* on November 22, 1996, and that same month a scoping statement was mailed to government agencies, municipalities, Native American Tribes, grazing permittees, lease operators, industry representatives, environmental organizations, and other agencies and individuals having a potential interest in the proposed project. The scoping statement explained the proposed project and invited comments regarding issues and concerns to be addressed in the EIS. Scoping meetings were held in Hanna, Laramie, and Rawlins on December 3, 4, and 10, 1996, respectively. Comments were accepted until January 3, 1997. Thirty-four comment letters (from 37 commentors) were received (Table 1.5). All scoping comments on the proposed project are considered in this EIS. On December 6, 1996, the BLM's Wyoming State Director notified the Governor of Wyoming that a lease application had been filed with BLM.

Key issues and concerns identified by the public, BLM, and other governmental organizations regarding the proposed project and analyzed in this EIS include the following:

- analysis of alternative coal-hauling routes and methods:
- conformance with GDRA RMP;
- cumulative impacts;

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Table 1.3 Major Federal, State, and Local Permits, Approvals, and Authorizing Actions.

Agency	Action	Authority
U.S. Bureau of Land Management	Prepare EIS	National Environmental Policy Act of 1969 (42 United States Code [USC] 4321 et seq., 40 CFR 1500-1508, 10 CFR 1021); Executive Order 11514 as amended by Executive Order 11991; Federal Land Policy and Management Act of 1976, as amended, Public Law 94-579
	Issue coal lease	Federal Coal Leasing Amendments Act of 1976, Public Law 94-377; Mineral Leasing Act of 1920, as amended; Surface Mining Control and Reclamation Act of 1977, Public Law 95-87
	Issue ROW grants	Title V, Federal Land Policy and Management Act, Public Law 94-579
U.S. Office of Surface Mining Reclamation and Enforcement	Cooperating agency for EIS preparation; prepare mining plan decision document	Mineral Leasing Act of 1920; National Environmental Policy Act of 1969 (42 USC 4321 et seq., 40 CFR 1500-1508, 10 CFR 1021)
U.S. Department of the Interior	Mining plan approval	Mineral Leasing Act of 1920
U.S. Environmental Protection Agency	Oversee NEPA and all permitting processes	See authorities for other federal agencies in this table
	Air quality oversight	Section 307 of the Clean Air Act
	Permit treatment, storage, or disposal of hazardous wastes	Resource Conservation and Recovery Act of 1976, as amended (42 USC 6901 et seq.)
U.S. Fish and Wildlife Service	Review impact on federally listed or proposed threatened and endangered species of fish, wildlife, plants; and migratory birds	Fish and Wildlife Coordination Act of 1934, as amended 1946, 1958, 1977 (16 USC 661-667e); Endangered Species Act of 1973 (16 USC 1531 et seq.); Migratory Bird Treaty Act of 1918, as amended (16 USC 703 et seq.); Eagle Act (16 USC 668-668d)
U.S. Army Corps of Engineers	Issue Section 404 permit for placement of dredged or fill material into waters of the U.S.	Section 404, Clean Water Act of 1977, amended 1987 (33 USC 1251-1376); Executive Order 11990
Wyoming Game and Fish Department	Review impact on threatened and endangered species, wildlife, and wildlife habitat	Fish and Wildlife Coordination Act of 1934, as amended 1946, 1958, 1977 (16 USC 661-667e)
Wyoming Department of Environmental Quality		
Air Quality Division	Issue permit to construct and modify	Clean Air Act (42 USC 7609)

Table 1.3 (Continued)

Agency	Action	Authority
Land Quality Division	Issue permits to mine	Wyoming Statute 35-11-112 (a)(i); Wyoming Statute 35-11-401 through 437
	Issue permit to explore	Wyoming Statute 35-413 through 414; Wyoming Statute 35-11-404
Solid and Hazardous Waste Management Division	Issue permit for solid waste facilities	Wyoming Statute 35-11-501 through 520
Water Quality Division	Issue Section 401 certification for stream crossings	Clean Water Act of 1977, amended 1987 (33 USC 1251-1376)
	Issue stormwater discharge permit	Clean Water Act of 1977, amended 1987 (33 USC 1251-1376); Wyoming Water Quality Rules and Regulations Chapter XVIII
	Notification of accidental release of hazardous substances into waters of the state	Wyoming Statute 35-11-301 and 35-11-302
Wyoming State Engineer's Office	Issue water well and dewatering permits	Wyoming Statute 41-4-501 et seq.; Wyoming Statute 41-3-301 et seq.; Wyoming Statute 41-3-930 et seq.
Wyoming State Historic Preservation Office	Consult with federal agency on site eligibility for National Register of Historic Places and the effects of the project on eligible sites	National Historic Preservation Act of 1966, as amended (16 USC 470); Historic Sites, Buildings and Antiquities Act of 1935, as amended (16 USC 461-467); American Indian Religious Freedom Act (42 USC 1996); Executive Order 11593; Antiquities Act of 1906 (16 USC 431-433, 43 CFR 3); Archaeological Resources Protection Act (16 USC 470aa et seq., 43 CFR 7); Archaeological and Historic Data Preservation Act of 1974 (16 USC 469-469c); Native American Graves Protection and Repatriation Act of October 1990 (25 USC 3001-3013)
Wyoming Department of Transportation	Issue access permit to access Highway 72	Rules and regulations for access driveways for Wyoming highways
Carbon County	Issue special use permit	County rules and regulations
	Issue building permit	County rules and regulations

Table 1.4 BLM and WDEQ Responsibilities for the Mine and Mine-Related Facilities.

Mine/Facility	BLM Responsibility	WDEQ Responsibility
All facilities within permit area[1], including mine pits, stockpiles, buildings, roads, etc., and the coal-handling facility, railroad, haul roads, conveyors, etc., if these facilities are permitted	Resource recovery and protection; respond to emergencies if WDEQ or OSM cannot respond before environmental harm occurs.	Regulate all development, operations, maintenance, and reclamation activities. Enforce environmental performance standards. These facilities would be bonded.
Facilities outside permit area:[2] Haul roads Power lines Railroads Conveyors Access roads used primarily for mine-related activities Coal-handling facility	Issue ROW grants and ensure compliance with ROW stipulations. Regulate development, operations, maintenance, and reclamation activities associated with these facilities. Enforce environmental performance standards. These facilities would be bonded.	None

[1] The *permit area(s)* would be the area(s) permitted by WDEQ for the surface mine and later the underground mine and may be slightly different than (but contained within) the *project area* analyzed in this EIS (see Section 1.3). It is not currently known whether the power line, coal-handling facility, railroad, haul roads, or conveyors would be permitted by WDEQ. If so, they would become part of the permit area. If not, they would (for the purposes of this table) be classified as facilities outside the permit area.

[2] The surface landowners would assume responsibility for facilities outside of the permit area. Private surface owners would be solely responsible for ensuring the lessee adheres to private agreements.

- public safety and travel/transportation management;
- road maintenance;
- social and economic effects on local communities;
- revenue generation and job availability;
- surface and groundwater impacts;
- direct and indirect wildlife habitat loss;
- big game winter range and migrations;
- threatened, endangered, candidate, and state sensitive species and their habitats;
- noise impacts on residents;
- protection of cultural resources and Native American spiritual values and compliance with applicable laws and Executive Orders;
- loss of recreational opportunities;
- air quality impacts;
- effects of the No Action Alternative; and
- impacts to Medicine Bow River and Seminoe Reservoir.

Other issues and concerns identified during the scoping process and analyzed in this EIS include:

- visual resources and aesthetics;
- noxious weed control;
- highly erodible and unstable soils;
- wetlands, wetland functions and values, waters of the U.S., riparian areas, and alluvial valley floors;
- paleontological resources;
- conformance with current and future land uses;

Table 1.5 Groups and Individuals from Whom Comments Were Received.

Citizens Groups
Biodiversity Associates/Friends of the Bow
Carbon County Coalition
Medicine Wheel Coalition
Wyoming Outdoor Council

Governmental Agencies
Federal
U.S. Army Corps of Engineers, Omaha District Office
U.S. Army Corps of Engineers, Wyoming Regulatory Office
U.S. Bureau of Reclamation
U.S. Fish and Wildlife Service

State
Department of Transportation
Office of the Governor
State Historic Preservation Office
Wyoming Game and Fish Department
Wyoming State Engineer's Office
Wyoming State Geological Survey

Carbon County
Carbon County Chamber of Commerce
Carbon County Economic Development Corporation
Carbon County School District No. 1
Carbon County School District No. 2

Individuals
T. Joe Bromley
Mike Chiropolos
John Howard
Craig Jones
Hope Jones
Mark Ledder
Jason Lillegraven
Barbara Parsons
Phil Reinbold
Robert Scherer II
Jack Tlustos
LaVonne Tlustos
Susan Tlustos
Tim Tlustos
Tony Tlustos

Industry
Carbon Power and Light Inc.
Louisiana-Pacific Corporation
Pacific Power

Native American Tribes
Oglala Sioux Tribe

- impacts to existing pipelines;
- increased traffic on roads and increased human activity in the lease area;
- potential for underground mining;
- impacts to existing water rights;
- impacts to other mineral resources (including oil and gas) and conflicts with other mineral development proposals;
- construction of electric transmission facilities;
- reclamation standards and procedures;
- disclosure of any and all of the applicant's violations of federal environmental laws;
- damage to other vehicles using haul route;
- mining method and mining plan;
- adequacy of data used in coal screening process;
- monitoring of impacts;
- mine subsidence;
- impacts on recreational opportunities;
- access to underground coal reserves;
- integration of coal screening process with environmental analysis; and
- energy requirements and conservation potential of alternatives.

This EIS was prepared by a third-party contractor (TRC Mariah Associates Inc. [TRC Mariah]), with the BLM as the lead agency and OSM as a cooperating agency providing guidance, input, participation, and independent evaluation. OSM intends to use this analysis to make decisions related to the mining of federal coal within the CBCPA.

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2.0 NO ACTION, PROPOSED ACTION, AND ALTERNATIVES

The detailed environmental analysis for the proposed lease sale includes an assessment of a No Action Alternative and the Proposed Action, which includes 10 transportation options (Table 2.1). The analysis in this EIS assumes that, because 79% of the surface-minable coal within the CBCPA is privately owned, it is highly probable that this coal would be mined even if the federal coal is not leased. Therefore, the No Action Alternative is a "no federal leasing" action rather than a "no mining" action. Surface-mining the federal coal in addition to the private coal would result in incremental increases in environmental consequences. Under the No Action Alternative, underground mining would not be feasible because the privately owned tract is discontinuous (i.e., in a checkerboard mineral ownership pattern) and thus not leasing the federal coal would make the privately owned underground coal uneconomical to mine. BLM would authorize the ROWs needed to facilitate surface mining of the privately owned coal. Because BLM does not have authority over private lands or private coal, this EIS does not analyze a no-mining alternative.

The No Action Alternative also would result in increased effects, over-and-above the effects caused by other existing and proposed developments. The CBCPA and surrounding region are being managed for a variety of uses including livestock grazing, wildlife habitat, windpower development, oil and gas development, municipalities, transportation, transmission, residential areas, etc., all of which contribute to the existing baseline described in Chapter 3.0 of this EIS. Impacts associated with the additive effects of mining to the existing baseline (which includes lands and other resources that have been impacted by current management) are evaluated in Chapter 4.0, in the discussion of cumulative impacts for each resource.

Under the Proposed Action, BLM would hold a competitive lease sale for surface- and underground-minable federal coal lands (Figure 1.2). Ark's initial LBA application of September 20, 1996, was modified by BLM on May 15, 1998, to include certain blocks of federal coal not originally applied for and exclude certain blocks due to environmental considerations. Ark subsequently revised their application to include BLM's May 15 modification. BLM may opt to hold the lease sale for surface- and underground-minable coal concurrently or to hold two sales, first for the surface-minable coal and later for the underground-minable coal such that surface mining could be initiated while the BLM's geologic and economic evaluation of the underground reserves is completed. Analysis of the Proposed Action, therefore, includes both leasing options and both the surface (Elk Mountain) and underground (Saddleback Hills) mines.

The EIS analyzes a No Action Alternative project disturbance area of 3,270 acres (Table 2.2). The Proposed Action (i.e., holding the lease sale) would add up to 1,626 acres of additional disturbance for a total of up to 4,896 acres (up to 50% more disturbance than for the No Action Alternative).

Arch currently provides coal to several local customers located in Laramie, Torrington, and Rawlins, as well as to customers throughout the U.S. Coal for local customers (150,000 tons in 1997) is currently hauled via over-the-road haul trucks directly from the Hanna Basin mines. Development of the new mines would allow these shipments to continue, probably at current levels.

The CBCPA includes the 18,360-acre project area shown in Figure 1.1. The transportation and power line ROWs associated with mine development and operations are primarily located outside the CBCPA.

2.1 THE NO ACTION ALTERNATIVE

2.1.1 Overview

Under the No Action Alternative, the coal lease would not be offered for competitive sale at this

Table 2.1 Comparison of Alternatives.

Attribute	No Action Alternative	Proposed Action	Transportation Options[1]
Resource Recovery and Protection Plan (R2P2) and Mine Permit Application	Arch would be required to prepare one mine permit application	Arch would prepare an R2P2 and two mine permit applications	No differences between options
Mining Plan	Surface mine only	Surface and underground mine	No differences between options
Mining Methods	Dragline and Archveyor™	Dragline, Archveyor™, Continuous Miners, and Longwall	No differences between options
Disturbance Acreage	3,249-3,270	4,322-4,896[2]	4,322-4,896[3]
Coal Mined	Surface - 22.45 million tons Underground - 0 tons	Surface - 31.1 million tons Underground - 88.0 million tons	No differences between options
Surface Mine Development	Facilities construction; erection of a dragline and Archveyor™; topsoil salvage; drilling, blasting, and removal of overburden; coal removal and transport; and reclamation	Same as for No Action Alternative	No differences between options
Underground Mine Development	No underground mine development	Cut entries and portals in pits created during surface mining; erect longwall miner; construct railroad and coal-handling facility	Railroad and coal handling facility construction would occur in 1999 or 2005; for some options, the coal handling facility would result in 170 acres more disturbance
Power Lines and Substations	One permanent and one temporary 115-kV power line, 3 substations	Same as for No Action Alternative except 4 substations	No differences between options
On-Site Facilities	Office complex, equipment-ready area, maintenance shop, water pump house, fuel station, storage yard, explosives storage area, parking lot, solid waste landfill, coal transfer station, 115-kV power line, and substations	Same as for the No Action Alternative except there could also be a railroad, a new coal-handling facility, or a conveyor	Depending on the option selected there could be a new railroad, coal-handling facility, haul road, or conveyor
Existing Facilities to Be Used	Seminoe II loadout including a hopper, primary and secondary crushers, covered conveyors, and a storage bin	Same as for No Action Alternative	No differences between options
Topsoil and Mine Rock Management	Stockpiles for topsoil and overburden established for any materials that cannot be backhauled directly; topsoil salvaged - 5,508,000 cu yd; overburden stripped - 107,742,000 cu yd	Stockpiles for topsoil and overburden established for any materials that cannot be backhauled directly; topsoil salvaged - 6,521,093 cu yd; overburden salvaged - 190,807,000 cu yd; up to an additional 413,013 cu yd salvaged during railroad construction	An additional 107,556-860,444 cu yd would be salvaged during transportation corridor construction

Table 2.1 (Continued)

Attribute	No Action Alternative	Proposed Action	Transportation Options[1]
Mine-water Discharge and Treatment	Pit sumps for dewatering the coal seam during surface mining, sediment ponds and ditches to control surface runoff	Same as for the No Action Alternative except that evaporation or discharge of water from underground mining would be necessary	No differences between options
Waste Disposal and Sewage Treatment	Solid waste and sewage disposal on-site in WDEQ-approved landfill and sewer system, respectively	Same as for the No Action Alternative	No differences between options
Water Requirements	24,000-26,000 gallons/day depending on the need for dust suppression	123,000-126,000 gallons/day	Haul road options would require more water use for dust suppression
Fencing	Substations would be fenced with a 12-ft chain-link fence, possible temporary fencing of reclaimed areas	Substations and underground mine portals would be fenced with a 12-ft chain-link fence, possible temporary fencing of reclaimed areas	No differences between options
Haul Truck Traffic on Highways 72 and 30/287[3]	Average daily traffic of 180-436 vehicles from 2000-2007	Average daily traffic of 222-900 vehicles from 2000-2010	No haul truck traffic on Highway 72 for Options 3-10
Employment	Temporary contractors - 5-54; permanent employees - 1-98	Temporary contractors - 5-54; permanent employees - 2-297	Slight variations in employment associated with coal transportation options
Public Access and Safety	Restricted public access to the mine, safety signing along Highways 72 and 30/287, curtailing over-the-road truck traffic when school buses are on the road	Same as for the No Action Alternative except that safety signing at any at-grade railroad crossings would be necessary	Safety signing would vary at railroad, haulroad, and conveyor crossings
Hazardous Materials	Hazardous materials associated with fuels, explosive, paint, combustion emissions, hydrocarbons, coolants/antifreeze, lubricants, power line emissions, and wood preservative (see Table 2.10)	Similar to the No Action Alternative, quantities may be slightly different and duration of use would be 12 years longer	Slight variations in the quantities of hazardous materials for the different transportation options
Life-of-mine and Project Time Line	Commence construction in 1999, begin surface mining in 2000, complete mining in 2007, complete reclamation in 2012	Commence construction in 1999, begin surface mining in 2000, begin underground mining in 2005, complete mining in 2020, complete reclamation in 2023	No differences between options
Reclamation	According to the WDEQ, LQD-approved reclamation plan	Same as for No Action Alternative	No differences between options

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[1] Described in Section 2.2.2.
[2] Disturbance under Proposed Action would depend on which transportation option is developed.
[3] Does not include an estimated average of 11 trips/day to serve local customers.

Table 2.2 Estimated New Disturbance, No Action Alternative and Proposed Action, Including Transportation Options.

Disturbance Type	No Action Alternative Acres	Proposed Action Acres	Incremental Increase in Disturbance from the Proposed Action Relative to the No Action Alternative Acres (%)
Facilities	183	413	230 (126)
Within-CBCPA haul roads	515[1]	496[3]	-19 (-4)
Within-CBCPA access roads	86[2]	100[4]	14 (16)
Topsoil and overburden stockpiles[5]	634	850	216 (34)
Coal pits[5]	1,027	1,236	209 (20)
Archveyor™ disturbances[6]	701	871	170 (24)
Power line and substations[7]	8-30	8-30	0
Ancillary facilities[8]	94	111	17 (18)
Total mine-related disturbance	3,248-3,270	4,085-4,107	837 (26)[9]
Option 1	n/a	4,325-4,347[10]	1,077 (33)[10]
Option 2	n/a	4,341-4,363	1,093 (33)
Option 3	n/a	4,486-4,533	1,263 (39)
Option 4	n/a	4,592-4,630	1,360 (42)
Option 5	n/a	4,713-4,751	1,481 (45)
Option 6	n/a	4,618-4,896	1,626 (50)
Option 7	n/a	4,392-4,430	1,160 (35)
Option 8	n/a	4,410-4,448	1,178 (36)
Option 9	n/a	4,546-4,568	1,298 (40)
Option 10	n/a	4,322-4,344	1,074 (33)
Maximum disturbance	3,270	4,896[11]	1,626 (50)

[1] Includes 4.2 mi of haul roads with a construction disturbance width of 750 ft for moving the dragline in 2002 and 5.5 mi of haul roads with a construction disturbance width of 200 ft. Includes acreage for primary haul road to be used to haul coal from the mine to Highway 72.

[2] Includes 3.0 mi of secondary roads to access substations, power lines, conveyors, etc., with a construction disturbance width of 200 ft plus 13 acres of existing roads.

[3] Includes 4.2 mi of haul roads with a construction disturbance width of 750 ft for moving the dragline in 2002 and 4.7 mi of haul roads with a construction disturbance width of 200 ft.

[4] Includes 3.6 mi of secondary roads to access substations, power lines, conveyors, etc., with a construction disturbance width of 200 ft plus 13 acres of existing roads.

[5] Maximum disturbance created by stockpiles and coal pits.

[6] There is potential for subsidence over areas that would be mined with the Archveyor™ which would remove a 15- to 20-ft thick coal seam out from under the overlying rock (see Section 4.1.5.1). Archveyor™-related subsidence would cause a 10-ft lowering of the surface, similar to that which would occur in the dragline pits. Potential Archveyor™ subsidence areas (shown on Figure 2.2) as Archveyor™ pits are included in the estimated 3,270 acres of disturbance under the No Action Alternative. Spoils also may be paced on the Archveyor™ disturbance areas, so these areas are counted as actual surface disturbance.

[7] Either 2.0- or 11.0-mi long power line, depending on the route selected, with a construction disturbance width of 20 ft plus 3 acres for substations. It is assumed that disturbance due to temporary power lines would occur in previously disturbed areas or this would be disturbed by pits, etc., that are already accounted for.

[8] Includes staging areas, etc.

[9] Calculations made using highest numbers only. For example, disturbance from the Proposed Action and option 1 is 4,347 acres - 3,270 acres = 1,077 acres.

[10] These numbers are the sum of 4,107 acres of mine-related disturbance plus the acreage associated with each transportation option. See Table 2.11 for explanation of the transportation options.

[11] Underground mine subsidence may result in an overall lowering of the landscape over approximately 7,322 acres, 4,107 of which would already be affected by surface mining (see Section 4.1.3.2). Since subsidence would not likely result in surface disturbance (e.g., disruption of soils or vegetation), the acreage potentially affected by subsidence is not included in this table but is addressed, as appropriate, in Chapter 4.0 of this EIS.

time. For the purposes of this analysis, the No Action Alternative assumes that the federal surface-minable coal would not be mined because once the adjacent private land and coal are developed, the surface-minable tract would be too small and scattered to be a viable independent mining unit. The No Action Alternative would result in a bypass of federal surface-minable coal; the economic and environmental consequences of mining the federal coal lands versus not mining them are compared in this EIS.

This EIS analyzes a projected No Action Alternative disturbance area of 3,270 acres within and adjacent to the CBCPA, including 30 acres of power lines and substations outside the project area (Table 2.3). The No Action Alternative would disturb 3,008 acres of private land, 95 acres of state land, and 167 acres of BLM-administered public land.

Mine development would begin in 1999. Surface mining would begin in 2000 and end in 2007. Final reclamation would be completed in 2012; thus the life-of-mine (LOM) would be 13 years. The bonding period would end in 2022, 10 years after final reclamation.

Power to the mine would be supplied via a 115-kV power line from one of two possible connections (Figure 2.1): 1) Western Area Power Administration's substation near Medicine Bow or 2) PacifiCorp's 230-kV transmission line (currently being constructed to convey power from SeaWest Energy Corporation's [SeaWest's] windpower generating facility [Wind Plant]) (BLM 1995a, 1995b, 1997b).

Surface mine (Figure 2.2) development would include: facilities construction; erection of a dragline and an Archveyor™ (a patented continuous mining machine and conveyor used to access deep but surface-minable coal more efficiently than with surface or underground mining methods) (Figure 2.3); topsoil salvage; drilling, blasting, and removal of overburden; coal removal and transport; and reclamation. On-site facilities would include: an office complex including administrative offices, changing and lunch rooms, sanitary facilities, and a service building; an equipment-ready area; a maintenance shop; a water pump house; a fuel station; a storage yard; a coal transfer station; a parking lot; a solid waste landfill; the 115-kV power line; substations; and an explosives storage area.

Portions of County Road 215 (Figure 2.1) would be upgraded to haul road standards and used to access Highway 72. Access to various support facilities (substations, power line, drill sites, monitoring wells, etc.) would be via WDEQ-approved roads within the CBCPA which would be relocated periodically during the LOM. Roads that are no longer needed for mine operations would be reclaimed during interim reclamation.

Arch has proposed to haul coal from the CBCPA north on Highway 72 to the existing Seminoe II loadout (Figure 2.1) where it would be loaded onto trains. During scoping, BLM received many comments concerning the safety hazard presented by hauling coal (up to 436 trips/day) through the town of Hanna. In response to these concerns, Arch; the WDEQ, Abandoned Mine Lands Program (AML); Wyoming Department of Transportation; and Carbon County have initiated plans to construct a two-lane bridge and a 2-mi long road on private land east of Hanna between Highway 30/287 and the end of Highway 72 at Elmo (herein referred to as the Hanna Bypass) (Figure 2.1). The Hanna Bypass would be a county road and available for public use before, during, and after mining. Funding for the project is being provided by Arch, AML, Wyoming's Industrial Road Project, and Carbon County. The Hanna Bypass is a county project that does not involve any federal lands; therefore, it is included only in the cumulative impacts analysis in this EIS.

2.1.2 Mine Permit Application

Under the No Action Alternative, one mine permit application would be prepared to satisfy WDEQ

Table 2.3 Estimated Annual Disturbance Under the No Action Alternative.

Year	Facilities	Haul Road	Secondary Roads[1]	Topsoil and Overburden Stockpiles[2]	Dragline Coal Pits	Archveyor™ Disturbances[3]	Power Lines and Substations	Ancillary Facilities[4]
1999	15	13	13	15	0	0	0	0
2000	168	82	11	88	100	109	30[5]	14
2001	0	38	14	93	142	149	0	11
2002	0	382[6]	10	113[7]	145	93	0	11
2003	0	0	8	79	115	82	0	10
2004	0	0	7	47	149	77	0	13
2005	0	0	10	95	103	52	0	11
2006	0	0	10	41	166	54	0	12
2007	0	0	3	63	107	85	0	12
2008	0	0	0	0	0	0	0	0
2009	0	0	0	0	0	0	0	0
2010	0	0	0	0	0	0	0	0
2011	0	0	0	0	0	0	0	0
2012	0	0	0	0	0	0	0	0
Total	183	515	86	634	1,027	701	30	94

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Table 2.3 (Continued)

Year	Total Disturbance (by year)	Cumulative Disturbance	Reclaimed Areas	Cumulative Reclaimed	Net Disturbance
1999	56	56	0	0	56
2000	602	658	151	151	507
2001	447	1,105	145	296	809
2002	754	1,859	160	456	1,403
2003	294	2,153	186	642	1,511
2004	293	2,446	281	923	1,523
2005	271	2,717	292	1,215	1,502
2006	283	3,000	368	1,583	1,417
2007	270	3,270	358	1,941	1,329
2008	0	3,270	372	2,313	957
2009	0	3,270	286	2,599	671
2010	0	3,270	304	2,903	367
2011	0	3,270	334	3,237	33
2012	0	3,270	20	3,257	13[8]
Total	3,270	–	3,257	–	–

[1] Roads within the CBCPA used to access substations, pits, drill sites, monitoring wells, and other facilities not shown on disturbance map; includes 13 acres of existing roads.

[2] Includes topsoil and overburden stockpiles, sediment ditches, and incised ponds along perimeter of disturbance.

[3] Archveyor disturbances include some overburden stockpiles and potential subsidence areas.

[4] Includes staging areas.

[5] Assumes maximum disturbance due to power line construction.

[6] Haul road to walk dragline from the southwestern portion of the CBCPA to central portion. Initially a 750-ft wide disturbance, it would be reclaimed to 150 ft wide and used as a haul road after the dragline moves.

[7] In 2002, the dragline would be moved to a new area and a new overburden stockpile would be created.

[8] Thirteen acres of existing roads would not be reclaimed.

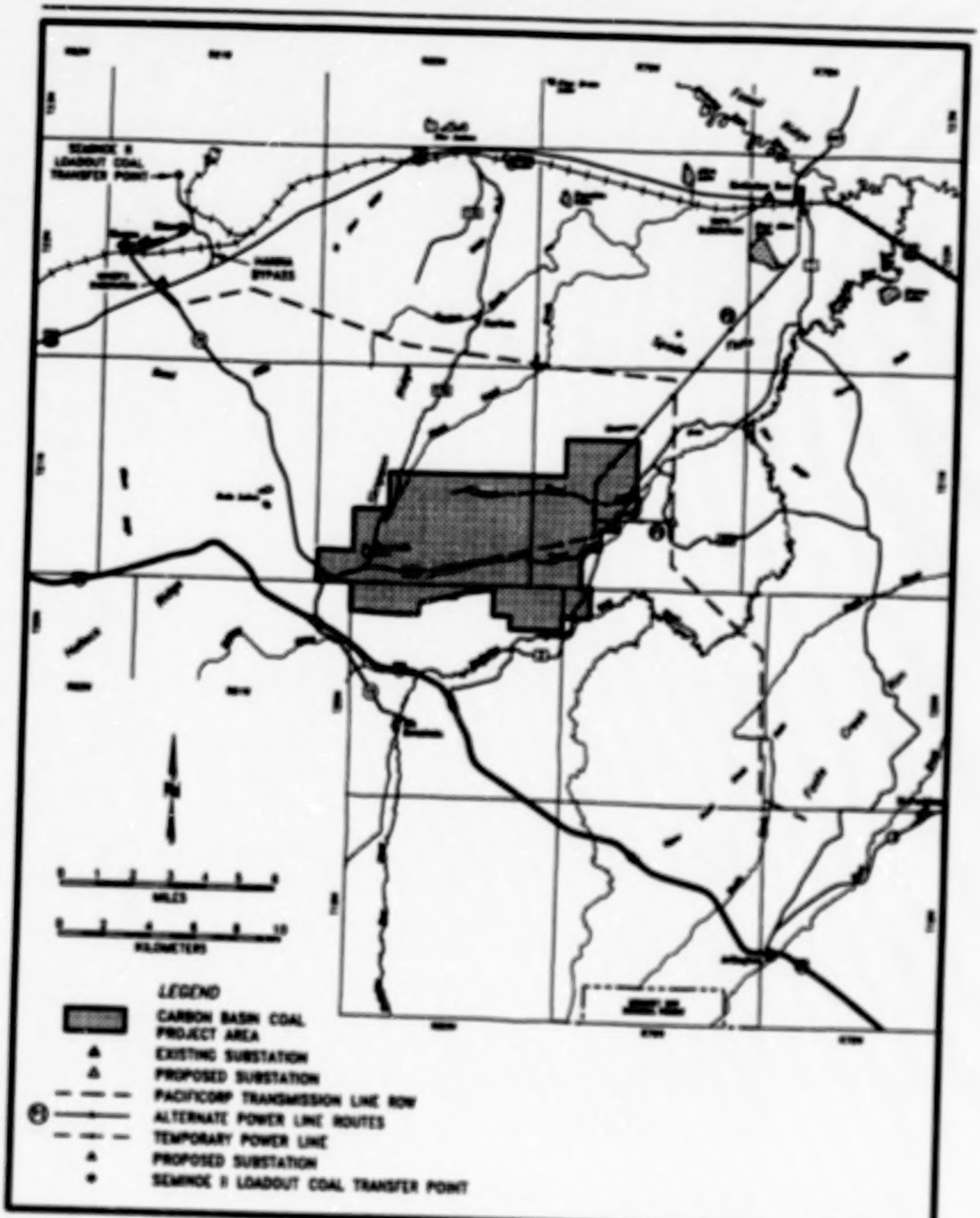
SEMINOE II LOADOUT COAL TRANSFER POINT
HANNA BYPASS
MILES
KILOMETERS
0 2 4 6 8 10
LEGEND
CARBON BASIN COAL PROJECT AREA
EXISTING SUBSTATION
PROPOSED SUBSTATION
PACIFICORP TRANSMISSION LINE ROW
ALTERNATE POWER LINE ROUTES
TEMPORARY POWER LINE
PROPOSED SUBSTATION
SEMINOE II LOADOUT COAL TRANSFER POINT

Figure 2.1 Carbon Basin Coal Project Area and Two Alternate Power Line ROWs.

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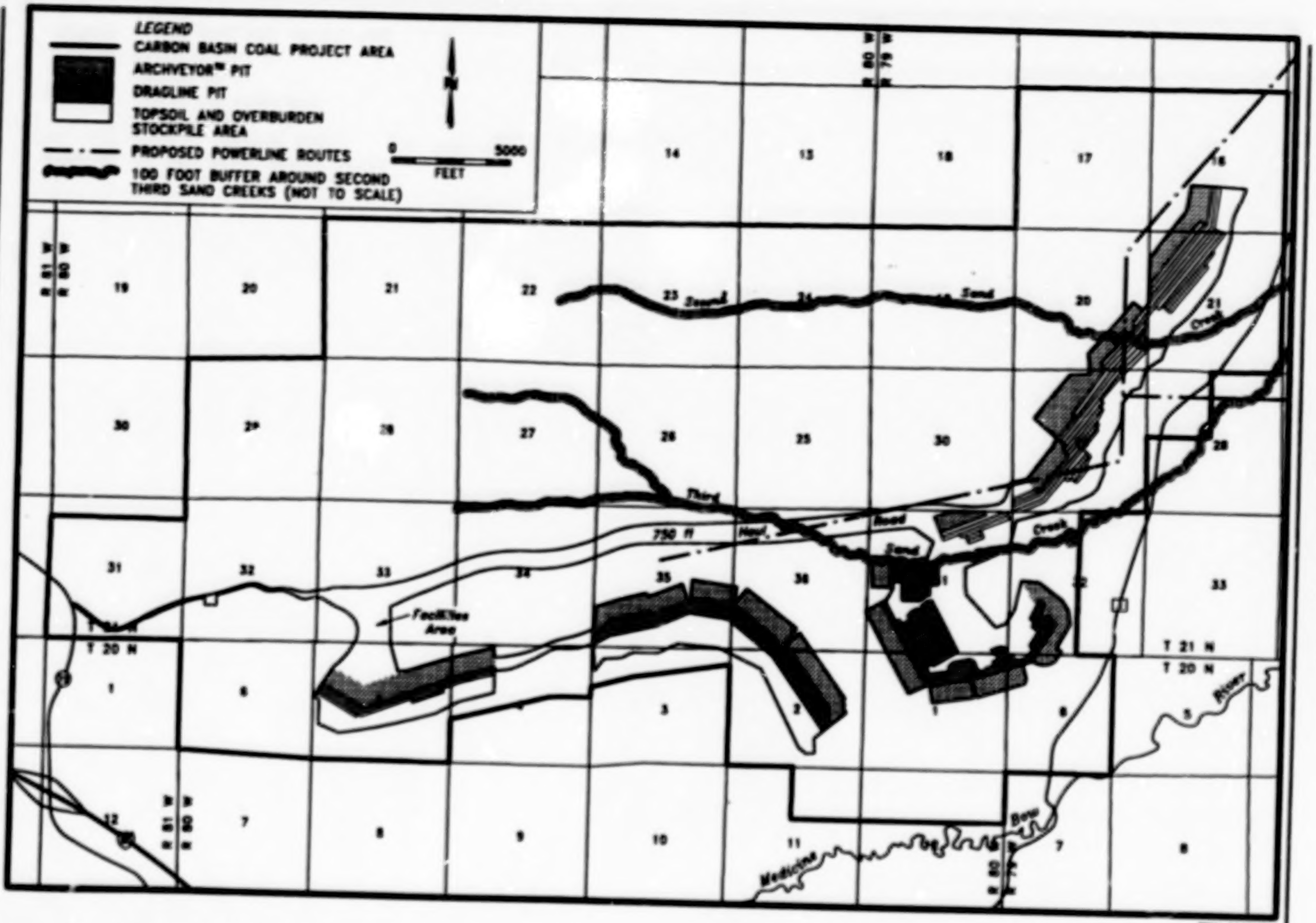
LEGEND
CARBON BASIN COAL PROJECT AREA
ARCHVEYOR™ PIT
DRAGLINE PIT
TOPSOIL AND OVERBURDEN STOCKPILE AREA
PROPOSED POWERLINE ROUTES
100 FOOT BUFFER AROUND SECOND THIRD SAND CREEKS (NOT TO SCALE)
N
0
5000
FEET
Second Sand Creek
Third Sand Creek
750 ft Haul Road
Facilities Area
T 21 N
T 20 N
Medicine Bow River

Figure 2.2 Generalized Mining Plan, Elk Mountain Mine, No Action Alternative.

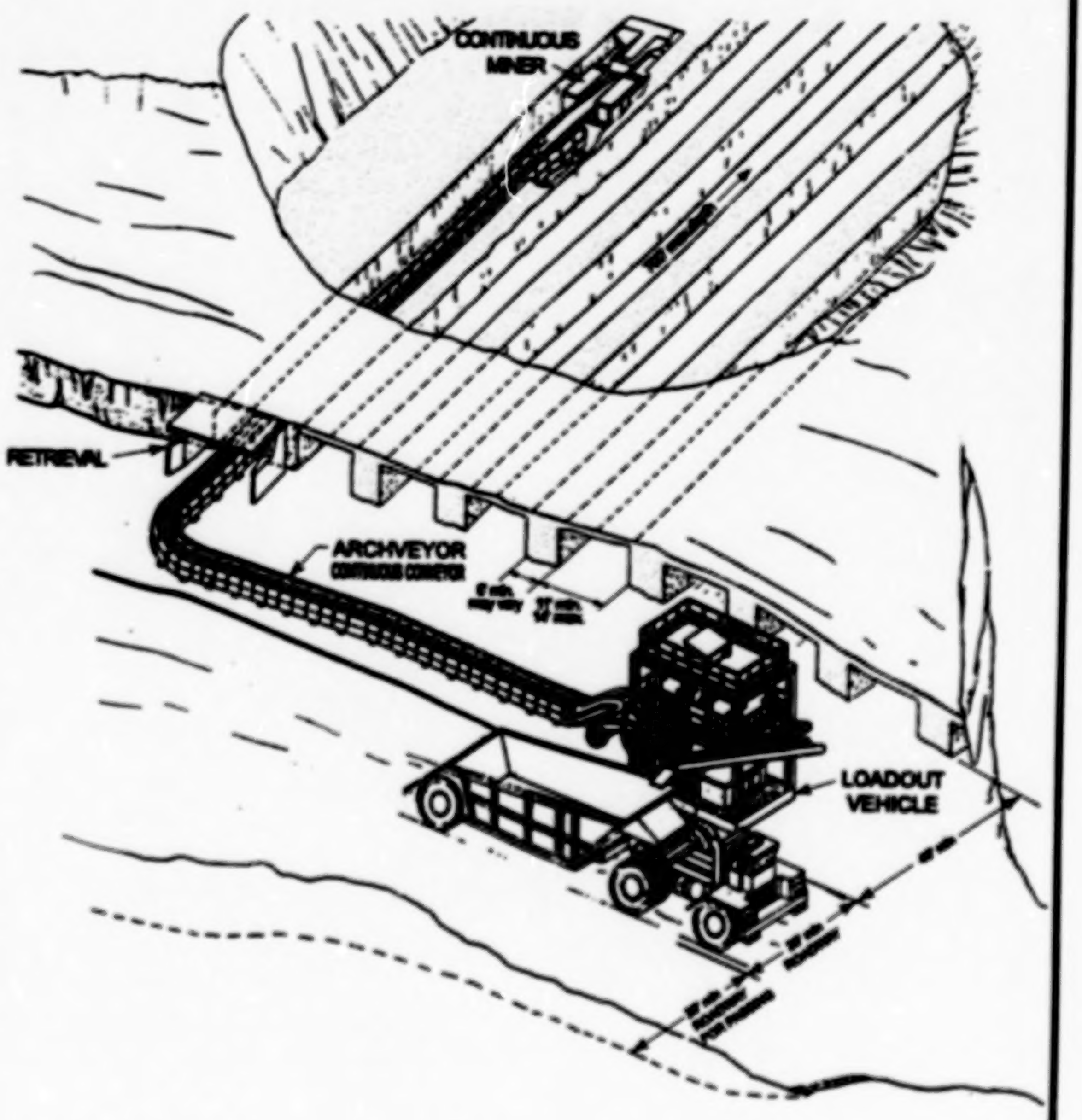

Figure 2.3 Archveyor™.

requirements for baseline analyses of affected resources and detailed mine, reclamation, and mitigation plans. Whereas Chapters 4.0 and 5.0 of this EIS present generalized mitigation measures and performance standards for mine development and operation, the mine permit application would include site-specific mitigation measures (e.g., placement of erosion control devices, location and construction of sediment ponds, drainage retention plans).

2.1.3 Mining Plan

2.1.3.1 Nature of Coal and Coal Reserves

Existing data on coal resources in the CBCPA have been developed from numerous surface exploration drill holes. The data indicate a good-quality coal resource with approximately 34,500,000 tons of surface-minable coal and 197,100,000 tons of underground-minable coal (see Table 1.1). Using state-of-the-art surface mining techniques, Arch would be able to recover 22.45 million tons (65%) of the surface-minable coal but none of the underground-minable coal under the No Action Alternative. The coal occurs in the Johnson seam of the Hanna Formation, a seam approximately 5-15 feet (ft) thick at the basin margins and up to 30 ft thick in the basin's interior. The coal has an estimated as-received heat content of 10,500-11,400 British Thermal Units (BTUs) per pound. The seam is bowl-shaped, dipping gently to the north, east, or west depending on location within the project area. Overburden thickness in the surface mine area ranges from 0 to 250 ft, whereas underground-minable coal is 250 to over 800 ft below ground surface. Sulfur content ranges from 0.60 to 0.68% (1.11-1.26 pounds [lb] SO_2 per million BTU, which may be blended to an average of 1.14 lb SO_2 per million BTU) which is within the 1.2 lb per million BTU SO_2 *Clean Air Act* amendment requirements for the year 2000.

Further exploration would be completed to determine the volume and quality of coal to be mined. Based on existing data, Arch proposes to begin surface mining in the southwestern portion of the lease area and mine in a northeasterly direction (Figure 2.2).

2.1.3.2 Mining Methods

Arch proposes to use two surface-mining methods at the Elk Mountain Mine: 1) conventional drilling and blasting combined with a dragline for overburden and coal removal and 2) an Archveyor™ continuous mining machine (see Figure 2.3) for mining coal on exposed highwalls. Approximately 15.05 million tons of coal would be mined using a dragline and 7.40 million tons would be mined using the Archveyor™.

The mining sequence would include: topsoil salvage; overburden drilling, blasting, and removal; and coal drilling, blasting, removal, and transport to a loadout/ coal-handling facility where the coal would be crushed and loaded onto trains for final transport. When the first pit is opened, topsoil and overburden would be salvaged and stockpiled separately, and coal would be removed. As mining progresses, topsoil would be salvaged in advance of the pit, and overburden removed with the dragline would be cast directly into a previously mined area and regraded. Thus, mining and backfilling would become a continuous operation, reducing the need to handle overburden material more than once. Pursuant to the approved reclamation schedule, salvaged topsoil would be replaced on regraded areas, and the area would be revegetated. Where possible, topsoil would be directly backhauled and placed on regraded areas. Large haul trucks (e.g., 200-ton capacity) would haul coal from the pits to transfer stations where it would be loaded onto over-the-road haul trucks.

Once a coal-bearing highwall has been exposed, additional coal would be mined using an Archveyor™ which consists of a modified continuous miner coupled with an articulated traveling conveyor system. The Archveyor™ would be computer-controlled to automatically shear up and down within a coal seam, dumping cut coal onto the conveyor. The conveyor would be approximately 5 ft off the ground and driven by 40 horsepower motors spaced at 24.5-ft intervals. A loadout at the conveyor's terminus would elevate the coal so that it could be loaded into haulage trucks (either over-the-road or 200-ton haul trucks).

Surface mining would begin with a pit in the southwestern portion of the CBCPA, and successive mining passes (i.e., topsoil salvage, overburden removal, and coal removal) would be made parallel to the pit's northern face, so that initial mining would advance in a northeasterly direction. The Archveyor™ would be erected after approximately five passes, after which both mining methods would be employed for the life of the surface mine. The anticipated production rate would be between 1.3 and 3.1 million tons per year (Table 2.4).

Protection of Second and Third Sand Creeks. As part of the mining plan, Arch would leave a 100-ft buffer of unmined land around Second and Third Sand Creeks (Figure 2.2). The only impact would occur in 2002 when the dragline would be walked from the southwestern to the northeastern portion of the CBCPA during which Third Sand Creek would be crossed twice. At each crossing, a temporary pad, constructed according to WDEQ requirements and composed of gravel, would be placed in the stream channel to provide a relatively level surface for dragline passage. Pad slopes would be stabilized using riprap, netting, or other appropriate material, and sediment fences or other sediment trapping devices would be placed at the base of the pad such that, if a storm occurs while the pad is in place, sediments would not be transported downstream. Pads would be in place no longer than 3-4 days; after the dragline passes, pads would be removed according to a WDEQ-approved plan. The dragline walk road would be reclaimed from 750 ft wide to 200 ft wide and used as a haul road for the remaining LOM. Culverts would be installed where the haul road crosses Third Sand Creek in accordance with the WDEQ-approved mining plan.

2.1.3.3 Mine Equipment and Facilities

Table 2.5 lists the types of equipment to be used during exploration and mine construction, operation, and reclamation. The specific numbers and equipment models would be determined as the mine sequence is developed and production rates are defined.

Existing equipment and facilities at the Seminoe II Mine would be used to the maximum extent possible during development and operation of the Elk Mountain Mine to minimize the need for newly constructed work and storage areas in the CBCPA. The existing Seminoe II facility occupies approximately 1,901 acres that are reclaimed, 1,418 acres that are currently being mined, and a 103-acre crusher/loadout facility and office complex. The Seminoe II loadout supports about 7 full-time employees. Existing coal-handling and storage facilities at the Seminoe II loadout available for use during the first 5 years of mining (when production rates are low) would include:

- a hopper;
- primary and secondary crushers;
- covered conveyors; and
- a 50,000-ton coal twin stacking silos from which coal would be loaded onto unit trains (100 rail cars, each with a capacity of 100 tons) at the existing rail spur.

Facilities to be constructed within the CBCPA would include:

- an office complex (administrative offices, changing and lunch rooms, sanitary facilities, and a service building);
- an equipment-ready area (a parking lot with electrical hookups for block heaters), a maintenance shop, a water pump house, a fuel station, and a storage yard;
- possibly a coal transfer station;
- a parking lot;
- a solid waste landfill;
- a 115-kV power line;
- electric power substations; and
- an explosives storage area.

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Table 2.4 Estimated LOM Soil/Overburden Mass Balance and Production Rate, No Action Alternative.

	Topsoil (thousand cu yd)			Overburden (thousand cu yd)				Coal Mined (million tons)	
Year	Stripped	Replaced	In Stockpiles	Stripped	Backfilled	In Stockpiles	Regraded	Surface	Underground
1999	25	0	25	0	0	0	0	0	0
2000	1,038	0	1,063	12,506	6,309	6,197	0	1.279	0
2001	691	0	1,754	12,807	6,460	12,544	0	2.976	0
2002	800	0	2,554	13,448	6,784	19,208	0	3.013	0
2003	610	407	2,757	13,950	7,037	19,774	6,347	3.083	0
2004	792	604	2,945	12,828	6,471	18,977	7,154	3.051	0
2005	645	653	2,937	13,023	6,569	18,010	7,421	3.127	0
2006	525	543	2,919	14,766	7,449	17,613	7,714	3.046	0
2007	382	717	2,584	14,414	7,271	17,363	7,393	2.875	0
2008	0	591	1,993	0	0	9,801	7,562	0	0
2009	0	680	1,313	0	0	5,708	4,093	0	0
2010	0	887	426	0	0	0	5,708	0	0
2011	0	426	0	0	0	0	0	0	0
Total	5,508	5,508	–	107,742	54,350	–	53,392	22.450	0

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Table 2.5 Estimated LOM Equipment Requirements, No Action Alternative.

Year	Archveyors™	Draglines	Drills	Dozers	Loaders	200-ton Haul Trucks	Scrapers	Graders	Water Trucks	Utility Trucks	Reclamation Equipment
1999	0	0	0	5	0	0	5	3	0	0	0
2000	0	1	2	5	4	5	5	3	0	0	0
2001	1	1	2	5	4	5	5	3	2	21	5
2002	1	1	2	5	4	5	5	3	2	21	5
2003	1	1	2	5	4	5	5	3	2	21	5
2004	1	1	2	5	4	5	5	3	2	21	5
2005	1	1	2	5	4	5	5	3	2	21	5
2006	1	1	2	5	4	5	5	3	2	21	5
2007	1	1	2	5	4	5	5	3	2	21	5
2008	0	0	0	0	0	0	0	1	1	3	5
2009	0	0	0	0	0	0	0	1	1	3	5
2010	0	0	0	0	0	0	0	1	1	2	5
2011	0	0	0	0	0	0	0	1	1	2	5

The service building would contain storage tanks for lubricating oil, antifreeze, hydraulic oil, transmission fluid, and solvents. The explosives storage area would be located at least 0.25 mi from the nearest building and shielded from the facilities area by earthen berms. Mine support facilities would be located in the southwestern portion of the project area (see Figure 2.2).

Utilities required for the mine would include electric power and telephone. A power line would be constructed to a central metering point within the CBCPA. A 115-kV distribution system would be constructed to supply power to offices, shops, and equipment. Electric power requirements are expected to average up to 1.3 million kilowatt hours per month. Telephone service would be provided by Union Telephone. Approximately 2 mi of telephone line would be installed from an existing line within the Highway 72 ROW (referred to as the Elk Mountain toll line) to the office complex.

If Arch is permitted to tie into PacifiCorp's 230-kV transmission line, a 230-kV to 115-kV step down permanent substation would be constructed at the tie-in (Figure 2.1). The exact tie-in location has yet to be determined, but it will likely be in the NENE sec. 27, T.21 N., R.79 W. If Arch chooses to tie into Western Area Power Administration's 115-kV line at Medicine Bow, no permanent substation would be needed. Two portable substations would be erected; one would step down power from Arch's 115-kV power line to 25 kV to serve the dragline, and one 115-kV substation would be used to serve the Archveyor™.

2.1.3.4 Topsoil and Mine Rock Management

Stockpiles for topsoil and overburden (i.e., rock that would be removed during surface mining to expose coal) would be established for any materials that cannot be backhauled directly to areas to be reclaimed. Stockpiles would be located along the southern margin of the Elk Mountain Mine, just outside the dragline pits (Figure 2.2). Any deviation from this plan would be approved by WDEQ prior to stockpile relocation.

Topsoil and overburden characterizations would be completed for the mine permit application. An Order 3 soil survey would be completed in all areas to be disturbed, and soils would be sampled and analyzed to determine suitability for reclamation and to identify appropriate salvage depths for each soil type. Salvage depths would probably range from 0 to 60 inches. Assuming an average salvage depth of 12 inches, the total volume of topsoil salvaged would be approximately 5,508,000 cubic yards (cu yd) (Table 2.4). Of this amount, up to 2,945,000 cu yd would be temporarily stockpiled; where possible, topsoil would be replaced directly on areas to be reclaimed.

Estimated overburden thickness ranges from 0 to 250 ft. Based on an average thickness of 118 ft, approximately 107,742,000 cu yd of overburden would be stripped during the LOM (Table 2.4). Approximately 54,350,000 cu yd would be backhauled or back-cast directly from the advancing pit into mined-out areas to avoid repeated handling. Stockpiling of up to 19,774,000 cu yd at any one time would be necessary due to pit turns and variations in the volume of overburden removed. Any topsoil or overburden material that is deemed unsuitable for reclamation would be stockpiled separately and buried according to WDEQ requirements as mined-out areas are backfilled.

All topsoil stockpiles would be protected from erosion, disturbance, and contamination (see Section 5.1.2.3). Actions to minimize wind and water erosion would include stockpile placement in areas that are sheltered from the wind, avoidance of steep slopes, and stabilization of stockpiles with temporary cover crops, netting, or mulch. Other practices may be implemented, depending on site-specific requirements.

2.1.3.5 Mine-Water Discharge and Treatment

The coal seam would be dewatered by pumping from pit sumps. Some of this water would be pumped into trucks and used for dust control, and excess water would be routed to WDEQ-approved sedimentation ponds where water would be evaporated or it would be discharged directly to the surface (into channels or ditches) in accordance with the National Pollution Discharge Elimination System permit. Ponds would be designed and built to contain mine-water plus runoff from the 10-year rain storm and designed to pass a 50-year storm. All ditches (e.g., around stockpiles) would be designed to pass a 100-year storm. Surface water control structures, designed to prevent excessive erosion and sedimentation in surface drainage caused by runoff from the mine, would be built in accordance with WDEQ standards (see Sections 5.1.2.6, 5.1.2.7, and 5.1.2.9).

2.1.3.6 Waste Disposal and Sewage Treatment

Solid waste from the mine may include floor sweepings, shop rags, lubricant containers, welding rod ends, metal shavings, worn tires, packaging material, used filters, and office and food wastes. These wastes would be disposed of within the permit boundary in a WDEQ-approved landfill in accordance with an approved solid waste disposal plan. A WDEQ-permitted sewer system consisting of a septic tank(s) and leach field(s) would be utilized for sewage disposal.

2.1.3.7 Water Requirements

The major water requirement would be for dust control along haul roads and for the Seminoe II loadout. Arch proposes to treat all gravel roads with a seasonal application of magnesium chloride to help with dust suppression and reduce overall water requirements. Water would also be needed for washing equipment, drinking, and showers and other sanitary facilities. During the LOM, total water requirements would be up to 26,000 gallons per day (Table 2.6).

Coal seam dewatering is expected to provide sufficient water for dust suppression and equipment operations. Water for showers, sanitary facilities, and equipment washing would be supplied by a 20,000- to 50,000-gallon water storage tank located at the office complex. Water for the tank would be obtained from a well constructed on-site and possibly supplemented with the municipal source at Hanna and transported to the mine site via water trucks. Purchased bottled water would be provided for drinking.

2.1.3.8 Fencing

The only fencing required for the LOM would be a 12-ft high chain-link fence around the proposed substations and other hazardous areas (e.g., explosives storage areas). During reclamation, newly reclaimed areas would be fenced, if necessary, with appropriate game- and/or livestock-proof fences. Reclaimed-area fences would be constructed around specific reclamation units such that wildlife and livestock movement through the area is not restricted, and they would be removed when no longer needed.

2.1.4 Road Construction

All roads would be constructed according to agency-approved standards (see Section 5.1.2.10). The two primary types of roads associated with the project would be haul roads and access roads (i.e., roads used for ingress to and egress from the mine and to access power lines, substations, facilities, etc.). Construction standards would typically be dictated by the Wyoming Department of Transportation through WDEQ and would also meet or exceed BLM, MSHA, and county standards.

Arch and the Wyoming Department of Transportation are currently negotiating an agreement to maintain or possibly improve the Highway 72 roadbed and surface to support the over-the-road haul truck traffic. Arch intends to utilize trucks with four axles pulling a tri-axle trailer and a six-axle pup trailer, for a total of

Table 2.6 Estimated Water Requirements, No Action Alternative and Proposed Action.

Equipment/Element Requiring Water	Daily Requirement (gallons/day)/Source No Action Alternative	 Proposed Action[1]
Dust suppression	8,000-9,000/Dewatering	Same/Same
Seminoe II loadout	15,000/Hanna municipal water	Same/Same
New coal-handling facility	N/A	14,000[2]/New well in CBCPA
Equipment washing, showers, and sanitary facilities	1,000-2,000/New well in CBCPA	Same/Same
Drinking	Variable/Purchased bottled water	Same/Same
Continuous and longwall mining system	N/A	100,000/Dewatering[3]
Total	24,000-26,000	123,000-126,000

[1] Same = same as for No Action Alternative.

[2] Some of this amount may be supplied by coal seam dewatering.

[3] Dewatering water may require settling and treatment to remove suspended solids and other impurities prior to use in the coal-handling facility and underground equipment.

13 axles. The gross vehicle weight would be within the Wyoming Department of Transportation maximum of 135,000 pounds, which equates to approximately 11,000 pounds per axle. Pipeline crossings would be upgraded, if necessary, to prevent disruption of pipeline operation.

Roads would be built, surfaced, and maintained to provide safe operating conditions at all times as determined by WDEQ or other agencies with jurisdiction for roads. Roads in areas of rough terrain or high erosion potential would be designed and monitored by a professional engineer. The minimum travelway width would be 24 ft for access roads and 100 ft for within-CBCPA haul roads. ROWs would average 48 ft for access roads and 200 ft for haul roads. Disturbance width would increase in rugged topography due to cuts and fills necessary to construct and stabilize roads on slopes but would not exceed the ROW.

Topsoil removed during road construction would be stockpiled in elongated rows within ROWs. Topsoil would be respread on disturbed areas not needed for operations, and these areas would be revegetated as soon as possible after road construction.

2.1.5 Power Line and Substation Construction

Power line construction would entail the following major activities: surveying, ROW preparation, materials hauling, structure assembly and erection, ground wire and conductor stringing, and cleanup and restoration. Power lines would be constructed and maintained by a contractor in conformance with National Electric Safety Code and other application codes and standards, as well as *Suggested Practices for Raptor Protection on Power Lines* (Olendorff et al. 1981) or any future updated versions available when construction is conducted. Table 2.7 provides a list of equipment typically used for power line construction.

Arch is proposing to construct two 115-kV power lines. The power line built to supply power to the mine would be between 2 and 11 mi long and located in part outside the CBCPA, depending on the route selected (see Figure 2.1). The line within the CBCPA, used to supply power to the mine's facilities, would be approximately 6.0 mi long. Both lines would be removed after mining is complete.

Power line centerlines would be surveyed and staked by a licensed surveyor, and preliminary structure locations would be identified. Construction materials would be hauled from temporary storage areas in nearby communities (e.g., Medicine Bow) to staging areas along the ROW or to structure locations. Staging areas would be established at 1-3 mi intervals along the route in relatively level areas where minimal vegetation clearing would be required. Staging area dimensions typically would be 200.0 x 200.0 ft. These areas would not be graded.

Trees within and adjacent to the power line routes would be removed as necessary to provide clearance for conductors. Vegetation clearing probably would not be necessary, and no blading would be needed.

The power line that provides power to the mine would be supported by twin-pole wooden structures placed at approximately 500-ft intervals along the ROW. Between 21 and 110 structures would be required, depending on the route selected. The power line used to serve within-mine facilities would be supported by single-pole structures placed at 175-ft intervals, for a total of 181 structures. Aboveground pole height would range from 45 to 55 ft. Structure holes would be approximately 3.0 ft in diameter and 10.0 ft deep and would be drilled or augered wherever feasible. In areas where consolidated rock could not be avoided, structure holes would be opened using a blasting agent. All blasting would be conducted by a permitted contractor and would be in compliance with state and federal regulations.

Pole erection and conductor stringing would occur sequentially along the ROW. On the power line that provides power to the mine, overhead wires would consist of three conductors and two continuous ground wires. The power line used to serve within-mine facilities would have three conductors and one continuous ground wire. Guy wires, which would be required at all turns, would be flagged or guarded (e.g., a bright yellow plastic sheath would be placed over the lowermost 8-10 ft of wire) to alert people, vehicles, big game, and livestock.

Existing public and private roads would be used to transport materials and equipment from the storage yard to ingress points along the power line ROW. The ROW (and existing roads, where feasible) would be used to access staging areas. Temporary use permits to access the ROW on public land from public roads would be obtained from the BLM. Landowner permission would be obtained prior to using private roads.

Final clean up and restoration would occur immediately following construction. Waste materials (e.g., brush, rock, construction materials) would be removed from the area and recycled or disposed of at approved facilities. Excess dirt would be tamped around poles or spread on the ROW. Revegetation of scalped or cleared areas would occur in the first fall following construction. Barriers may be placed where the ROW intersects roads to prevent unauthorized traffic on the ROW, if required by BLM.

2.1.6 Transportation and Traffic

2.1.6.1 Transportation

Under the No Action Alternative, coal would be hauled using over-the-road trucks via the primary haul road (County Road 215, as upgraded) to Highway 72, north to Highway 30/287, east to the

Table 2.7 List of Equipment Typically Used for Power Line Construction.[1]

Equipment	Function
Tracked tractor with blade	Remove vegetation from staging areas and along selected portions of the ROW to improve access
Wagon drill mounted on the back of a rubber-tired vehicle	Test for rock prior to drilling pole holes
Drilling rig and auger mounted on the back of a rubber-tired vehicle	Dig pole and anchor holes
Setting crane or cable rig puller pulled by a tracked tractor	Raise and set the structures
Framing truck	Carry crews and materials to assemble the structures
Truck-mounted air compressor with tamps	Tamp backfilled soil around the poles after the structure is in place
Flatbed trucks and pole trailers	Haul crossarm materials and distribute poles
Truck-mounted A-frames	Unload material and erect structures
Forklifts	Unload poles, erect structures, and frame
Truck-mounted high reach	Aerial framing and clipping
Winch truck	Realign structures pulled out of alignment during conductor stringing
Truck-mounted tensioner	String conductor
Truck-mounted cable reels	String conductor
Five to 10 pickup trucks	Transport supervisory and construction crews

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[1] PacifiCorp (1994).

Hanna Bypass, then north to the crusher system at the Seminoe II Mine from which it would be loaded onto coal trains. Approximately 150,000 tons per year of coal for Arch's local customers would be supplied by the mine and would be hauled via the primary haul road to Highway 72, south to Interstate 80 (I-80), and then east and west to Laramie, Rawlins, and Cheyenne and north on Interstate 25 (I-25) to Torrington, as is the currently employed from Arch's existing mines.

Employees and contractors would use existing roads and roads developed for the project to access the mine.

During power line construction, existing roads would be used to transport materials and equipment from storage yards to staging areas and would be used for all maintenance activities. At this time, no new road construction for the power line is anticipated.

During mine development and operation, all vehicles would be restricted to existing roads and roads developed for the project. Use of unimproved roads would be limited to emergency situations and authorized monitoring activities. Speed limits would be set commensurate with road type, traffic volume, vehicle type, and site-specific conditions as necessary to ensure safe and efficient traffic flow. Signs would be placed along the roads to identify speed limits, travel restrictions, and other traffic control information.

2.1.6.2 Traffic

Overview. Highway 72 was designed for a volume of 744 vehicles per day (average daily traffic) (personal communication, June 1998, with Andrew Long, Wyoming Department of Transportation). In 1996, the average daily traffic was 290 vehicles per day, 40 of which were tractor-trailer trucks (personal communication, June 1998, with Shawn Miller, Wyoming Department of Transportation). Under the No Action Alternative, average daily traffic would be 232-624 vehicles per day (Table 2.8) so traffic on Highway 72 (mine-related plus 1996 vehicles) would total 552-914 vehicles per day. Arch is currently negotiating with the Wyoming Department of Transportation to maintain and possibly upgrade Highway 72 to support the anticipated volume of traffic.

Construction Traffic. Construction of mine roads, facilities, the dragline, and the Archveyor™ would occur simultaneously using single vehicles for multiple tasks. The average number of daily vehicle trips (average daily traffic) to and from the mine site would be approximately 160 vehicles per day during the period from October 1999 to February 2000 (Table 2.8). Most vehicles traveling to and from the mine during construction would be pickup trucks, although up to 10 trips per day would be large trucks (e.g., tractor-trailers) hauling equipment (e.g., pieces of the dragline).

Power line construction would require approximately 23 round trips per day during pole erection and conductor stringing.

Operation and Reclamation Traffic. Employee traffic would range from 34 to 168 trips per day for surface mine operations (Table 2.8). An estimated 180-436 trips per day would be needed to haul coal. Of this amount, approximately 11 trips per day would be made to serve Arch's local customers. Over-the-road haul trucks would run 24 hours per day, except when school buses are using Highways 72 and 30/287 (see Section 2.1.10).

Large trucks (e.g., tractor-trailers) would make approximately 18-20 daily trips to and from the mine during operation to deliver equipment and bulk supplies (e.g., explosives). If Arch is unable to develop an on-site water source, two 5,000-gallon water trucks would make an average of two trips per day, for a total of four trips per day. Snow removal equipment would be utilized as needed during winter. As is the situation for Arch's current operations, most employees would

Table 2.8 Estimated Mine-Related Traffic, No Action Alternative.

			Average Daily Traffic on Public Roads			
Activity	**Time Frame**	**No. Days**	**Cars/ Pickups**	**Coal Haul Trucks**	**Other Large Trucks**	**All Vehicles Combined**
Initial construction (haul road, access roads, facilities, power line)	Oct 1999-Feb 2000	80	150	0	10[1]	160
Surface mine operations	Jan 2000-Dec 2007	2,840[2]	34-168	180-436	18-20[3]	52-188
Initial and interim reclamation	Sep 2000-Dec 2007	480[4]	30	0	6	36
Final reclamation	Jan 2008-Dec 2012	180[5]	40	0	6	46
Coal transportation	Jan 2000-Dec 2007	2,840	0	180-436	0	180-436

[1] Includes two trips per day for water trucks for dust suppression during construction.
[2] Assumes that the mine would operate 355 days per year.
[3] Includes four trips per day for water trucks for equipment washing, showers, and sanitary facilities.
[4] Assumes that reclamation would occur 60 days/year for 8 years.
[5] Assumes that reclamation would occur 60 days/year for 3 years.

commute from Hanna via Highway 72 or from Medicine Bow via a county road or from Laramie and Rawlins via I-80 (see Section 3.4), so traffic would be distributed on several different roads.

Power line maintenance would require about two round trips per year and approximately two round trips per day would be needed during reclamation of the power line routes.

2.1.7 Employment and Employee Access

An estimated 43-114 employees and contractors would be required during the first 2 years of mine development for road, power line, and facilities construction and dragline assembly (Table 2.9). Once the infrastructure has been developed, surface mine operations would require approximately 24 employees on each of three 8-hour shifts per day (total of 72 employees) plus an additional 26 staff for the LOM. Most employees would be transferred from the Seminoe II and Medicine Bow Mines, which are in the final years of production; this would enable Arch to avoid major layoffs associated with mine closure. Arch currently employs approximately 90 operators and staff, and by the third year of mine development, there would be enough jobs at the new mine to continue this employment and eight new jobs would be created. An estimated 54-60 truck drivers would be employed by the over-the-road haul truck contractor. Arch would use local contractors, whenever feasible.

Table 2.9 Predicted LOM Employment Requirements, No Action Alternative.

Year	Coal Production Year	Surface Operators	Underground Operators	Construction Employees	Staff	Employee Total	Contractors	Total
1999	0	0	0	21	0	21	22[1]	43
2000	1	38	0	18	22	78	36[1,2]	114
2001	2	59	0	8	26	93	7[3]	100
2002	3	59	0	0	26	85	7[3]	92
2003	4	72	0	0	26	98	7[3]	105
2004	5	72	0	0	26	98	7[3]	105
2005	6	72	0	0	26	98	7[3]	105
2006	7	72	0	0	26	98	7[3]	105
2007	8	72	0	0	26	98	7[3]	105
2008	0	54	0	0	26	80	5[4]	85
2009	0	27	0	0	8	35	5[4]	40
2010	0	12	0	0	4	16	5[4]	21
2011	0	7	0	0	1[5]	8	5[4]	13
2012	0	7	0	0	1	8	5[4]	13

[1] Topsoil salvaging, pond and ditch construction.

[2] An additional 54-60 contractor truck drivers would be employed for over-the-highway haulage.

[3] Topsoil salvaging, blasting, and reclamation.

[4] Reclamation.

[5] One staff member would be required for approximately 10 years after final reclamation to manage the property and monitor reclamation until all bonds are released.

2.1.8 Life-of-Mine and Project Time Line

Under the No Action Alternative, mine development would commence in 1999 and mining would begin in 2000. The surface mine LOM is based on an estimated sustained production rate of 1.3 to 3.1 million tons/year (see Table 2.4), although rates will depend on market conditions. Based on an estimated reserve of approximately 22.5 million tons, the LOM would be 8 years (see Table 2.3). Final reclamation would begin in 2008 and would take approximately 5 years to complete (2012). The 10-year bond liability period would end in 2022, provided that WDEQ-approved reclamation success criteria have been met.

2.1.9 Existing Leases and ROWs

There are currently no producing oil and gas wells within the CBCPA (DeBruin and Boyd 1991; Wyoming Oil and Gas Conservation Commission [WOGCC] 1996). The Simpson Ridge field is located adjacent to the project area (sec. 20, T.21 N., R.80 W.) but is plugged (personal communication, June 1998, with Nancy Barclay, WOGCC). There were three oil/gas wells in this field, but there are no related oil/gas pipelines that would need to be relocated or otherwise protected to prevent damage during mining operations. Sinclair Oil Corporation holds several oil and gas leases on federal land within the area. If any productive oil and gas wells are drilled on the LBA tract, an agreement could be reached with the oil and gas operator to plug the wells beneath the coal, cut off the casing, and either abandon them or restore them to production after backfilling is complete.

Other ROW-holders within the CBCPA include:

- Carbon Power and Light (Transmission Line ROW),
- The Utilities of Wyoming (Telephone/telegraph ROW),
- Energy Reserves, Inc. (Road ROW),
- Carbon County Commission (Road ROWs),
- Colorado Interstate Gas Transmission Company (Pipeline ROW), and
- SeaWest (Wind Plant ROW).

In 2005, the Carbon Power and Light power line would be moved out of sec. 29 and sec. 31, T.21 N., R.79 W., and sec. 2, T.20 N., R.80 W., and relocated to follow County Road 3. Service would not be disrupted during the move, and it would be relocated back to its original position during final reclamation. In 2004, County Road 3 in the NW sec. 28, T.21 N., R.79 W., would be relocated to the east so that it remains outside the rail loop.

In 1997, BLM granted SeaWest and PacifiCorp ROWs to construct and access a Wind Plant and a 230-kV transmission line, respectively, east, north, and northwest of the CBCPA (see Figure 4.1) (BLM 1997b). SeaWest's Simpson Ridge project area overlaps with the CBCPA in sec. 29, T.21 N., R.80 W. Arch and SeaWest have developed agreements on how this shared section would be used by both development activities. If PacifiCorp allows Arch to tap into the 230-kV transmission line, there would be no need for a longer transmission line to Medicine Bow.

2.1.10 Public Access and Safety

Under the No Action Alternative, over-the-road coal haulage would occur for all 8 years of mining. Public access to the mine would be restricted for the LOM. Visitors would be allowed on-site in accordance with MSHA and state regulations, which require specific safety protocols for mine workers and visitors.

Safety signing would be posted around the CBCPA perimeter, the access road, and transformers and other high voltage facilities in conformance with applicable state and federal regulations.

Arch would place signs at the interchange between I-80 and Highway 72, at Hanna Junction, and at the intersection of the primary haul road with Highway 72 to warn motorists of haul truck traffic on the route. Similar warning signs would also be placed along the segment of Highway 30/287 to be included in the haul route and at the intersection between the Hanna Bypass and Highway 30/287. Haul trucks would be required to stop at intersections as required by state law. Running lights (headlights and yellow side markers) would also be required. Haul truck traffic would be temporarily halted whenever school buses are transporting children on Highway 72 or the segment of Highway 30/287 included in the haul route.

The project area is within a full fire suppression area (i.e., wildfires are extinguished as soon as possible) (BLM 1990:14). Because mine personnel would be on-site 24 hrs per day and in communication with central operations, any fires would be noted immediately and reported to local authorities. Fire extinguishers would be located in the facilities area and in vehicles.

2.1.11 Hazardous Materials

Arch has reviewed the U.S. Environmental Protection Agency's (EPA's) *Consolidated List of Chemicals Subject to Reporting Under Title III of the Superfund Amendments and Reauthorization*

Act of 1986 (SARA) (as amended) and EPA's list, *List of Extremely Hazardous Substances* as defined in 40 CFR 355 (as amended), for hazardous substances proposed for use in this project. Arch maintains a file containing Material Safety Data Sheets for all chemicals, compounds, and/or substances which are or would be used during mine development, mining, and reclamation. Hazardous materials anticipated to be used or produced during the implementation of the No Action Alternative fall into the following categories:

- fuels - gasoline (potentially containing benzene, toluene, xylene, methyl tert-butyl ether, and tetraethyl lead) and diesel fuel;
- combustion emissions - nitrogen oxides (NO_x), carbon monoxide (CO), and nonmethane hydrocarbons (NMHCs);
- coolants/antifreeze;
- lubricants - grease (potentially containing complex hydrocarbons and lithium compounds) and motor oil;
- explosives;
- paints;
- solvents;
- power line emissions - ozone and NO_x; and
- wood preservative for power line poles.

Substances that would be used and produced during this project are listed in Table 2.10.

Major lubrication, oil changes, etc., of most equipment would be performed inside the service building, where waste oil would be contained and deposited in a storage tank. Spent fluids would be recycled via a certified waste contractor. Construction and mining equipment would be properly maintained at all times to minimize leaks of motor oils, hydraulic fluids, and fuels.

The wooden structures used for the power line and railroad ties would be treated with pentachlorophenol wood preserver. Pentachlorophenol is listed as hazardous by the EPA. However, power poles and railroad ties would be coated off-site, and thus there is no potential for spills or leaks of wood preservative (except the small amount which leaches off the wood).

Approximately 30 transformers would be used at the mine site and would each contain between 35 and 2,900 gallons of insulating oil, for a total of approximately 17,400 gallons. Insulating oil would not contain polychlorinated biphenyls (PCBs) and would be stored in completely sealed containers.

Arch and its contractors would comply with all applicable federal laws and regulations existing or hereafter enacted or promulgated. Arch and its contractors would locate, handle, and store hazardous substances in an appropriate manner to prevent contamination of soil and water resources or otherwise sensitive environments. Any release of hazardous substances (leaks, spills, etc.) in excess of the reportable quantity established by 40 CFR, Part 117, would be reported as required by the *Comprehensive Environmental Response, Compensation, and Liability Act* of 1980 (CERCLA), as amended. If the release of a hazardous substance in a reportable quantity occurs, a report would be furnished to WDEQ and all other appropriate federal and state agencies. Prior to construction, Arch would prepare a Spill Prevention Control and Countermeasure (SPCC) Plan, inventories of hazardous chemical categories pursuant to Section 312 of the SARA, as amended, and Emergency Response Plans which would be kept on-site at all times.

Unanticipated events, such as spills, are always possible; however, Arch is committed to all planning and emergency procedures required by local, state, and federal laws and regulations regarding spill prevention or reporting and cleanup, should accidents occur.

2.1.12 Reclamation

Reclamation would be completed throughout the LOM as construction and mined-out areas are no longer required for operations. A detailed reclamation plan, including a reclamation

Table 2.10 Hazardous and Extremely Hazardous Materials Used and Produced During Mine Development and Operations, No Action Alternative.

Source	Hazardous[1] and Extremely Hazardous[2] Constituents	CAS Number[3]	Quantity	Storage Practice
Explosives	Ammonium nitrate	6484-52-2	1,180 pounds per hole	Removed daily
	Diesel fuel (see below)	68476-34-6		
	Nitroglycerin	55-63-0		
Detonators	Chromium	7440-47-3		
	Lead	7439-92-1	500 detonators per blast	Removed daily
Fuses	Black powder	–	800-1,200 ft per blast	Removed daily
Paint	Barium	7440-39-3	<20 gallons on-site at any given time	Appropriate paint storage cabinets
	Cobalt	7440-48-4		
	Lead	7439-92-1		
	Manganese	7439-96-5		
	PAHs[4]	–		
	POM[5]	–		
	Sulfuric acid	7664-93-9		
	Xylene (mixed isomers)	1330-20-7		
Solvents	Glycol ethers	–	25 gallons on-site at any given time	Appropriate solvent storage containers
Lubricants/oils	Barium	7440-39-3	15,000 gallons on-site at any given time	Machine reservoirs and approximately 5,000 gallons in storage tanks; excess stored in tanks and removed by licensed contractor
	Butyl benzyl phthalate	85-68-7		
	Cadmium	7440-43-4		
	Copper	7440-50-8		
	Lead	7439-92-1		
	Manganese	7439-96-5		
	Nickel	7440-02-0		
	PAHs	–		
	POM	–		
	Zinc	7440-66-6		
Coolant/antifreeze	Ammonia	7664-41-7	3,000 gallons on-site at any given time	Machine reservoirs
	Ethylene glycol	107-21-1		
Unleaded gasoline	Benzene	71-43-2	35 gallons per pickup truck	Approximately 1,000 gallons in storage tanks
	Cyclohexane	110-82-7		
	Ethylbenzene	100-41-4		
	Hexane	110-54-3		
	Methyl tert-butyl ether	1634-04-4		
	PAHs	–		
	POM	–		

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Table 2.10 (Continued)

Source	Hazardous[1] and Extremely Hazardous[2] Constituents	CAS Number[3]	Quantity	Storage Practice
Unleaded gasoline (cont.)	Toluene	108-88-3		
	Xylene-m	108-38-3		
	Xylene-o	95-47-6		
	Xylene-p	106-42-3		
Diesel fuel	Benzene	71-43-2	30,000 gallons	10,000 gallons in machines and 20,000 gallons in storage tanks
	Ethylbenzene	100-41-4		
	Methyl tert-butyl ether	1634-04-4		
	Naphthalene	91-20-3		
	PAHs	–		
	POM	–		
	Toluene	108-88-3		
	Xylene-m	108-38-3		
	Xylene-o	95-47-6		
	Xylene-p	106-42-3		
Combustion emissions	Barium	7440-39-3	Unknown	
	Cadmium	7440-43-9		
	Copper	7440-50-8		
	Fine mineral fibers	–		
	Lead	7439-92-1		
	Manganese	7439-96-5		
	Nickel	7440-02-0		
	Nitrogen dioxide[6]	10102-44-0		
	Ozone[6]	10028-15-6		
	PAHs	–		
	POM	–		
	Sulfur dioxide[6]	7446-09-5		
	Sulfur trioxide[6]	7446-11-9		
	Zinc	7440-66-6		
Wood preservative	Pentachlorophenol	87-86-5	None on site	None

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[1] As defined under the U.S. Environmental Protection Agency's Consolidated List of Chemicals Subject to Reporting Under the Emergency Planning and Community Right-to-know Act (Title III of the Superfund Amendments and Reauthorization Act) of 1986.

[2] As defined in Appendix A of 40 CFR 355, *The List of Extremely Hazardous Substances and Their Threshold Planning Quantities*.

[3] Chemical Abstract Service Identification Number.

[4] Polynuclear aromatic hydrocarbons.

[5] Polycyclic organic matter.

[6] Extremely hazardous substance.

schedule, would be developed for the ROWs and the mine permit pursuant to BLM and WDEQ regulations. Once construction is complete, all disturbed areas not required for operations would be reclaimed. Arch will finish reclaiming the existing Medicine Bow and Seminoe II Mines and then transfer reclamation personnel and equipment to the Elk Mountain Mine. No more than four successive cuts would be made before spoils piles from previous cuts are regraded, topsoiled, revegetated. When mining is complete, the postmining topography would be restored to the approximate original contour or an approved equivalent. Slopes would be regraded, topsoiled, and revegetated. Facilities, including power lines, would be removed to at least 6.0 inches below ground level and facilities areas would be reclaimed as required by the WDEQ-approved reclamation plan. The final topography would be similar to the premining topography, but postmining slope gradients would be slightly less steep (e.g., 0-12% compared with 0-13%).

Each phase of reclamation (i.e., postconstruction, interim, and final reclamation) would involve the following steps. Spoils would be regraded to a WDEQ-approved postmining topography. Topsoil would be replaced on graded spoils and tilled and treated to prepare the seedbed. Tillage and treatment methods would vary depending on soil type and landscape position, but would probably include ripping, discing, and possible addition of soil amendments. Prepared areas would be seeded with an approved seed mixture, and newly seeded areas would be protected, as appropriate, from wind and water erosion, grazing by livestock and wildlife, and unauthorized traffic using mulches, netting, fencing, signing, or other appropriate methods. Weeds would be controlled according to an approved weed-control program. The detailed reclamation plan would be included in the ROWs and mine permit.

Final reclamation would begin in 2008 and would take approximately 5 years to complete (i.e., 2012).

2.2 THE PROPOSED ACTION

2.2.1 Overview

Under the Proposed Action, BLM would hold a coal lease sale of the LBA tract (see Figure 1.2), subject to coal lease stipulations developed in the Planning Review EA (BLM 1997a) and this EIS. Because the proposed project area is within an area of "checkerboard" landownership (a pattern of alternating sections of federal, state, and private land), the use of federal land is needed for optimal mine development. This EIS analyzes a projected Proposed Action disturbance area of up to 4,896 acres (up to 50% more than under the No Action Alternative) from mining and from power line, railroad, and road corridors outside the LBA tract (see Table 2.2). Surface landownership of disturbed lands would include approximately 4,320 acres of private land, 179 acres of state land, and 397 acres of BLM-administered public land.

Surface mining would occur as described for the No Action Alternative with an additional 837 acres (a 26% increase) disturbed because more coal would be surface-mined (see Table 2.2). Underground mine development would occur within the pits created by surface mining. Portals would be constructed using continuous mining machines to cut the main entries to the underground coal. Additional on-site facilities would include an underground longwall mining system. Depending on the transportation option selected, the coal-handling facility, used to load coal into railcars, would be located within the CBCPA or near Medicine Bow. Two additional 115-kV substations would be required to operate underground mine equipment and the coal-handling facility. Once the underground mine is near full production, the existing Seminoe II loadout facility would be disassembled and reclaimed according to Arch's currently approved reclamation plan (Permit No. 377-T4). Facilities and transportation corridor construction (e.g., coal-handling facility, haul roads, a railroad) would create up to 789 acres of additional disturbance, for a total surface disturbance of up to 4,898 acres.

2.2.2 Transportation Options

Arch's proposed transportation plan would include 6 years (2000-2005) of hauling coal via the primary haul road west to Highway 72, north on Highway 72 to Hanna Junction, east on Highway 30/287 to the Hanna Bypass, and then north on the Hanna Bypass to the Seminoe II loadout (Figure 2.1). Concurrent with underground mine development, Arch proposes to construct a railroad between the CBCPA and the Union Pacific Railroad near Medicine Bow (Figure 2.4), and beginning in 2005, all coal (except for local customers) would be hauled via rail. However, in response to public concern about haul truck traffic on Highway 72, BLM has developed additional transportation options (Table 2.11 and Figures 2.5-2.8). Selection of one or more transportation options over Arch's proposal to haul coal on Highway 72 for the first 6 years of mining would alleviate the safety hazards and maintenance concerns for Highway 72, but would also have ramifications for other resources such as wildlife, visual resources, air emissions, etc. Any ROWs outside the permit area would include a BLM-approved ROW reclamation plan. Environmental consequences of each option are analyzed as part of the Proposed Action in Chapter 4.0 of this EIS.

2.2.3 Resource Recovery and Protection Plan (R2P2) and Mine Permit Applications

As part of the Proposed Action, Arch would prepare a detailed Resource Recovery and Protection Plan (R2P2) for BLM and two mine permit applications for WDEQ. The R2P2 would describe how the proposed operation would meet MLA requirements for diligent development, production, resource recovery and protection (i.e., efficient recovery of the federal coal reserves), continued operation, maximum economic recovery, and the rules of 43 CFR 3480 for the LOM. MLA requires that, before conducting any federal coal development or mining operation on federal coal leases, the operator must submit an R2P2 within 3 years of the effective date of the lease. The lessee is obligated to mine according to the approved R2P2 or face lease suspension or cancellation.

The two mine permit applications would be prepared to satisfy OSM and WDEQ requirements for baseline analyses of affected resources and detailed mine, reclamation, and mitigation plans. Whereas Chapters 4.0 and 5.0 in this EIS present generalized mitigation measures and performance standards for mine development and operation, the mine permit applications would include site-specific mitigation measures (e.g., placement of erosion control devices, location and construction of sediment ponds, drainage restoration plans).

2.2.4 Mining Plan

2.2.4.1 Mining Methods

Surface Mining. Under the Proposed Action, the surface mine (Figure 2.9) would be developed and operated as described for the No Action Alternative although more coal would be mined using surface-mining methods (Table 2.12). Large trucks (e.g., 200-ton capacity) would haul coal from the pits to transfer stations or coal-handling facilities, depending on the transportation option selected. Of the 34.5 million tons of surface-minable coal, an estimated 31.1 million tons (90%) would be recovered (25% more than for the No Action Alternative). Of the 197.1 million tons of underground-minable coal, 88.02 million tons (45%) would be recovered. The anticipated production rate would be between 1.3 and 7.7 million tons per year.

Underground Mining. Underground mining would be performed using a standard longwall mining system which utilizes a shearing device with two rotating drums for cutting coal (Figure 2.10), a self-propelled hydraulic roof support, and a conveyor to continuously mine coal. During the first year of underground mine development

Table 2.11 Transportation Options for Hauling Coal from the CBCPA to the Seminoe II Loadout and the Union Pacific Railroad.

Option No.	Description	Disturbance Due to Transportation Option, by Facility (Acres)	Total Disturbance Due to Transportation (Acres)
1	Arch's proposed transportation plan: transport coal using over-the-road trucks via Highway 72 and the Hanna Bypass to the Seminoe II loadout from 2000-2005 and then by rail beginning in 2005. The coal-handling facility would be constructed in a surface mined area so would not result in additional disturbance.[1] Railroad route R1 would be 12.4 mi long.[2]	Railroad: 240	240
2	Same as Option 1 except railroad route R2 would be 13.2 mi long.	Railroad: 256	256
3	Transport all coal by rail beginning in 2000. This option would involve construction of a railroad during surface mine development. It would also involve construction of the coal-handling facility in a previously undisturbed area. Coal-handling facility construction would disturb 170 acres.	Coal-handling facility: 170 Railroad: 240-256	410-426
4	During the 2000-2005 period, transport coal to the Seminoe II loadout using 200-ton haul trucks on new haul roads developed specifically for the mine;[3] transport via rail and reclaim the haul road beginning in 2005. The coal-handling facility would be constructed in a surface-mined area so would not result in additional disturbance. Haul road B1 would be 11.0 mi long.	Haul road: 267 Railroad: 240-256	507-523
5	Same as Option 4 except haul road B2 would be 16.0 mi long.	Haul road: 388 Railroad: 240-256	628-644
6	Same as Option 4 except haul road B3 would be 22.0 mi long.	Haul road: 533 Railroad: 240-256	773-789
7	During the 2000-2005 period, transport coal using covered conveyors;[4] transport coal via rail and reclaim the conveyor routes beginning in 2005. The coal handling facility would be constructed in a surface mined area so would not result in additional disturbance. Disturbance width due to conveyor construction would be 50 ft. Conveyor route C1 would be 11.0 mi long.	Conveyor: 67 Railroad: 240-256	307-323
8	Same as Option 7 except conveyor route C2 would be 14.0 mi long.	Conveyor: 85 Railroad: 240-256	325-341
9	No railroad construction. Transport coal via 200-ton haul trucks on a new haul road to a new coal-handling facility near Medicine Bow. The haul road (D1) would be 12.0 mi long.	Haul road: 291 Coal-handling facility: 170	461
10	No railroad construction. Transport coal via covered conveyor to a new coal-handling facility near Medicine Bow. The conveyor route (D2) would be 11.0 mi long.	Conveyor: 67 Coal-handling facility: 170	237

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Table 2.11 (Continued)

[1] The Seminoe II loadout would not be adequate for the anticipated coal production levels once underground mining commences, so a new coal-handling facility is a necessary eventuality if the underground mine is developed. Under options 1, 2, 4, 5, 6, 7, and 8, the new coal-handling facility would be constructed in an area that was surface-mined during the first few years of mining, so no additional disturbance would occur from coal-handling facility construction. Under option 3, it would be necessary to construct the coal-handling facility in an undisturbed area in the CBCPA. Under options 9 and 10, it would be necessary to construct a new coal-handling facility near Medicine Bow.

[2] The railroad would terminate in sec. 29, T.22 N., R.79 W., and would merge with the Union Pacific Railroad in either sec. 11, T.22 N., R.79 W., or sec. 10, T.22 N., R.78 W. (Figure 2.4). Railroad construction would cost approximately $1,375,000 per mile (personal communication, July 1998, with Ed Turner, Arch), or $17,050,000 to $18,150,000, depending on the route selected.

[3] The haul road would have a 100-ft full-surfaced travelway and 20-ft shoulders, for a total road width of 140 ft, and it would be constructed in accordance with agency-approved standards. Haul road construction would cost approximately $141,000 per mile (personal communication, July 1998, with Ed Turner, Arch), or $1,551,000 to $3,102,000, depending on the route selected.

The ROW would be 200 ft. The Highway 30/287 crossing would be reinforced with a 3-ft thick concrete slab to prevent highway damage.

Under transportation options 4, 5, and 6, the number of 200-ton trips per day would range from 23 to 136, depending on production rates. The haul road would cross Highway 30/287 and the Union Pacific Railroad in one to three locations, and trucks would be required to stop at these intersections. The road would also cross several county and local roads en route. Motorists would be required to stop at these intersections, giving haul trucks the right-of-way. Signs would be placed on Highway 30/287 and all county and local roads to warn motorists of haul truck traffic. Once the new railroad becomes operational, the haul road would be reclaimed in accordance with landowner preferences. Over-the-road haul trucks would be used only to serve Arch's local customers at a rate and in a manner similar to that currently used for the existing mines.

[4] The conveyor (options 7, 8, and 10) would consist of a series of rubber belts mounted on rubber rollers and supported by a metal framework (see Figure 2.7). Passage for wildlife, livestock, ranchers, recreationists, and other area users would be established at regular intervals. The metal framework would be supported by a wooden base (e.g., railroad ties), and steel cables would be used to maintain tension along the conveyor. Coal would be loaded onto the conveyor via a portable crusher/hopper system. A small access road would also be required for conveyor construction and maintenance and would be constructed to agency-approved standards. Conveyor construction would cost approximately $4,725,000 per mile (personal communication, July 1998, with Ed Turner, Arch) or $51,975,000 to $66,150,000, depending on the route selected.

Note: Landownership along the transportation corridors is as follows.

Transportation Corridor	Federal (mi)	State (mi)	Private (mi)
R1	1.6	2.4	8.4
R2	3.4	0.6	9.2
B1	4.0	0.7	6.3
B2	4.0	1.0	11.0
B3	2.3	1.9	17.8
C1	3.5	0	7.5
C2	3.8	1.0	9.2
D1	4.6	0	7.4
D2	3.6	1.5	5.9

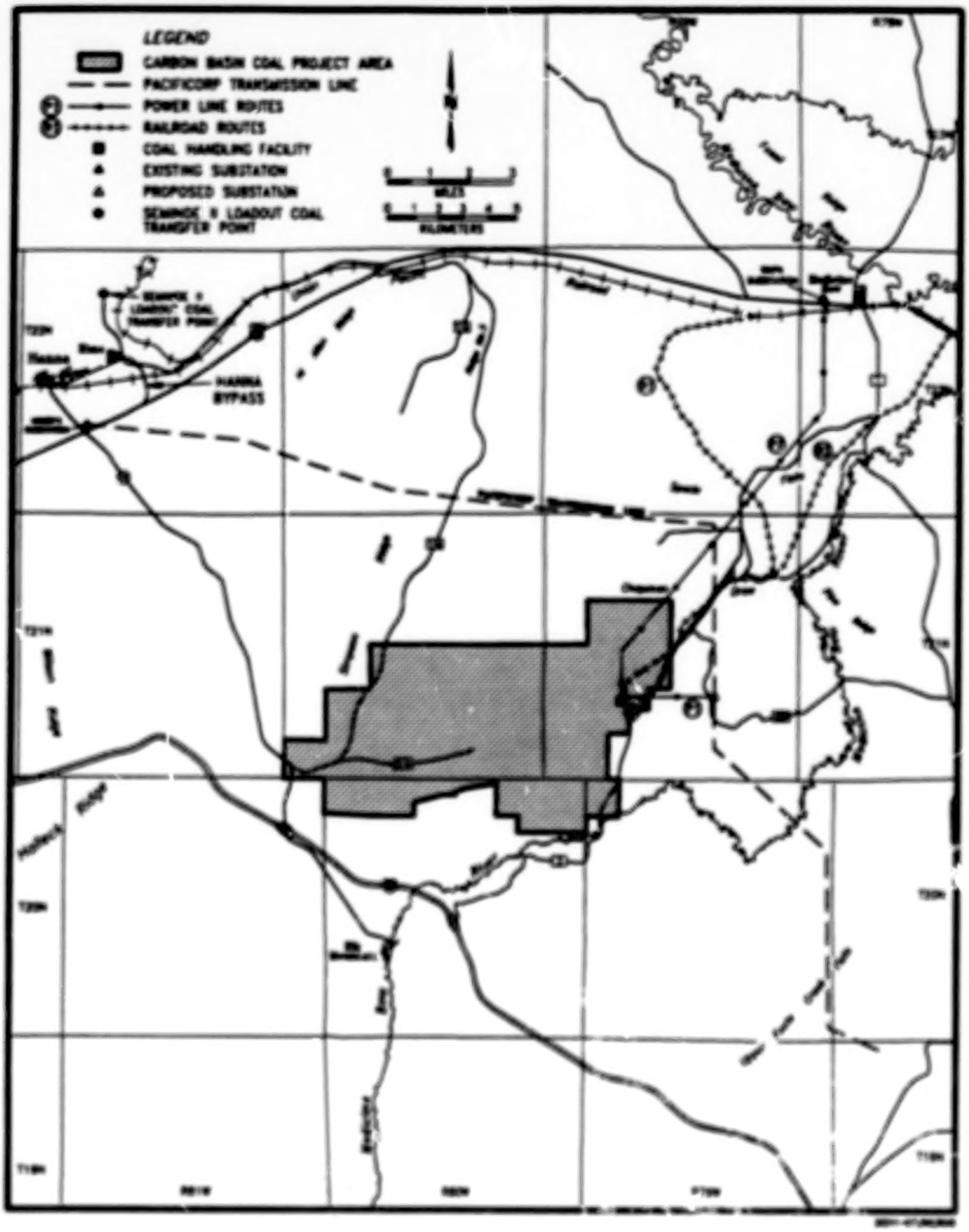

Figure 2.4 Railroad, Transportation Options 1-8.

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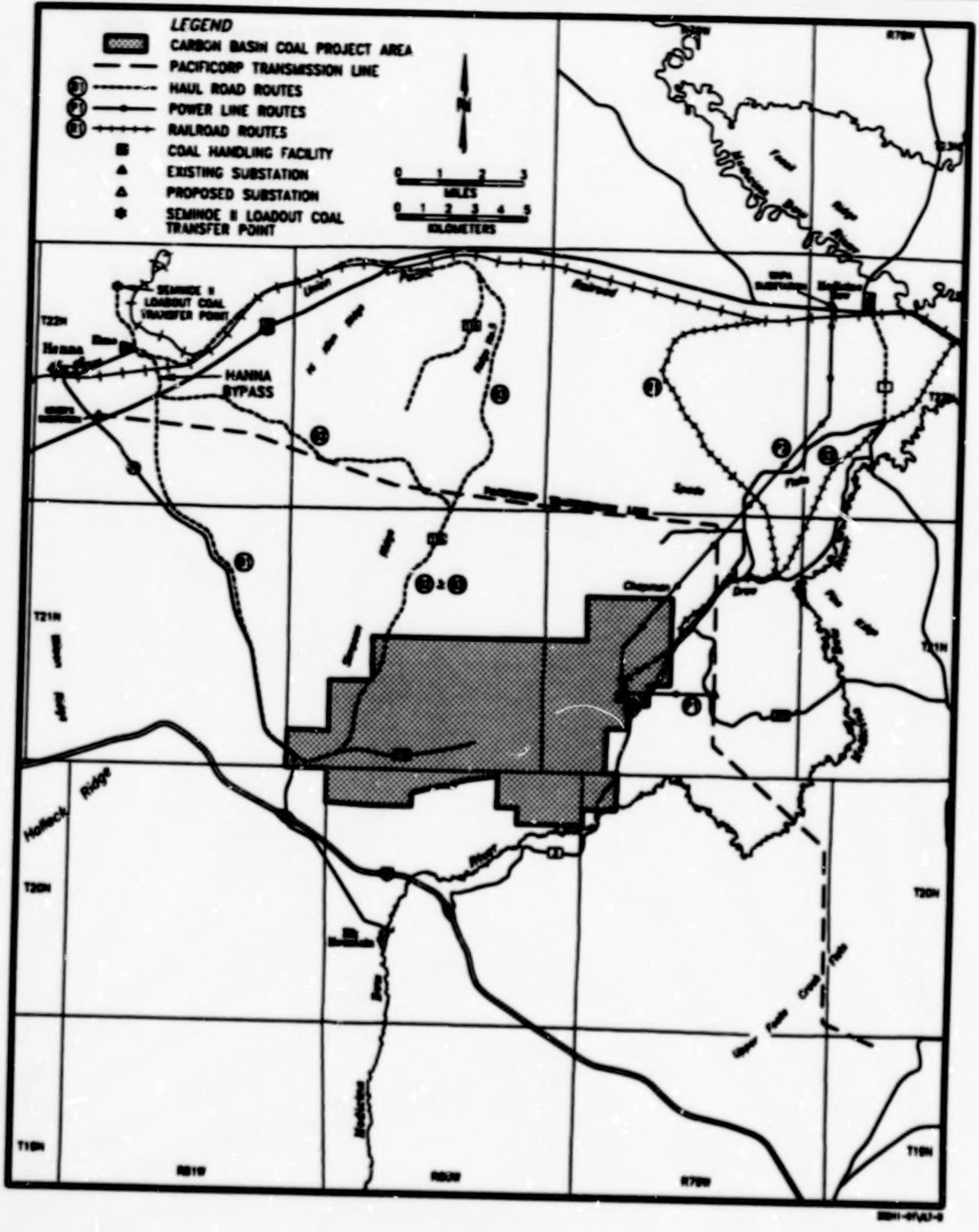

Figure 2.5 Haul Road, Transportation Options 4, 5, and 6.

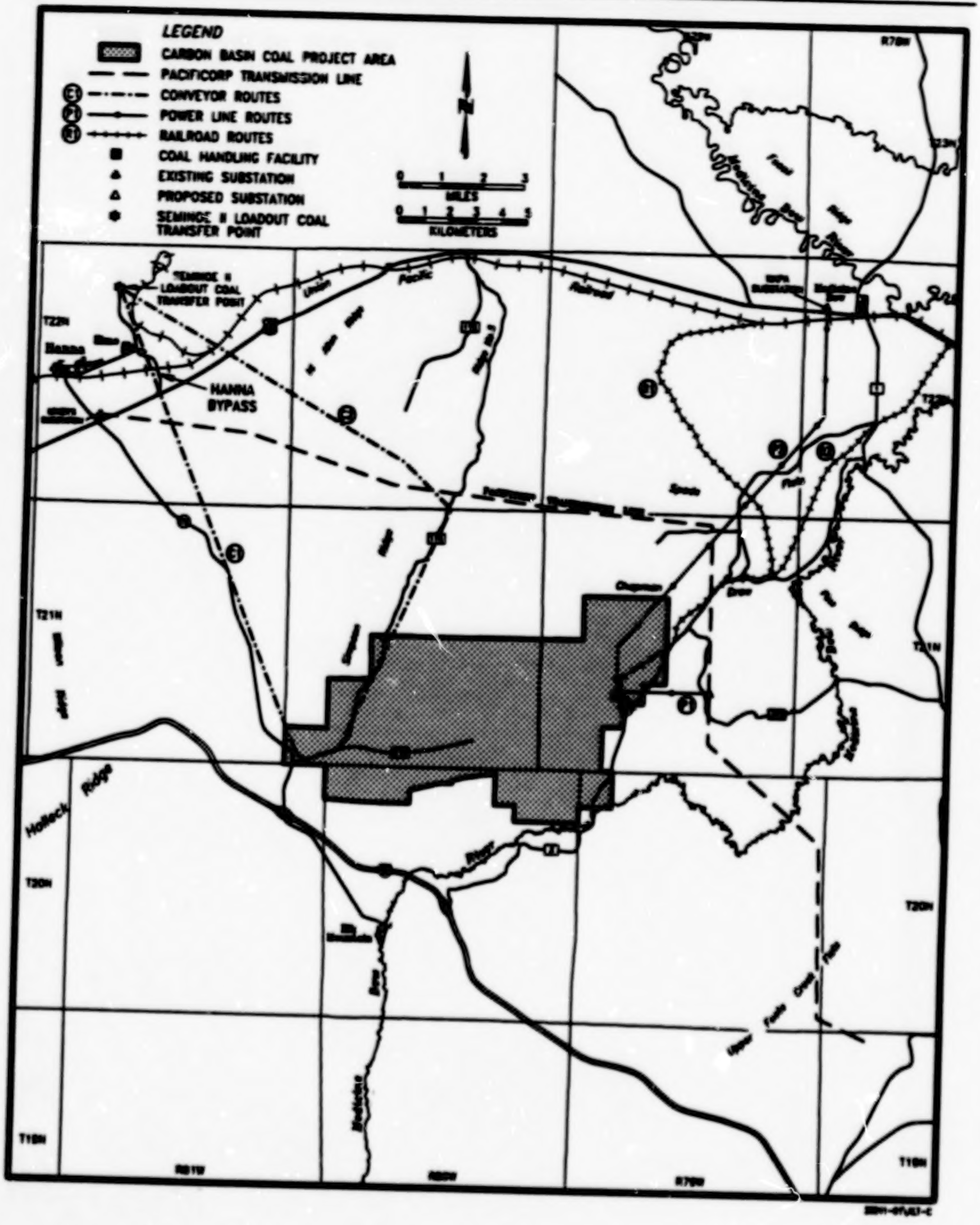

Figure 2.6 Conveyor, Transportation Options 7 and 8.

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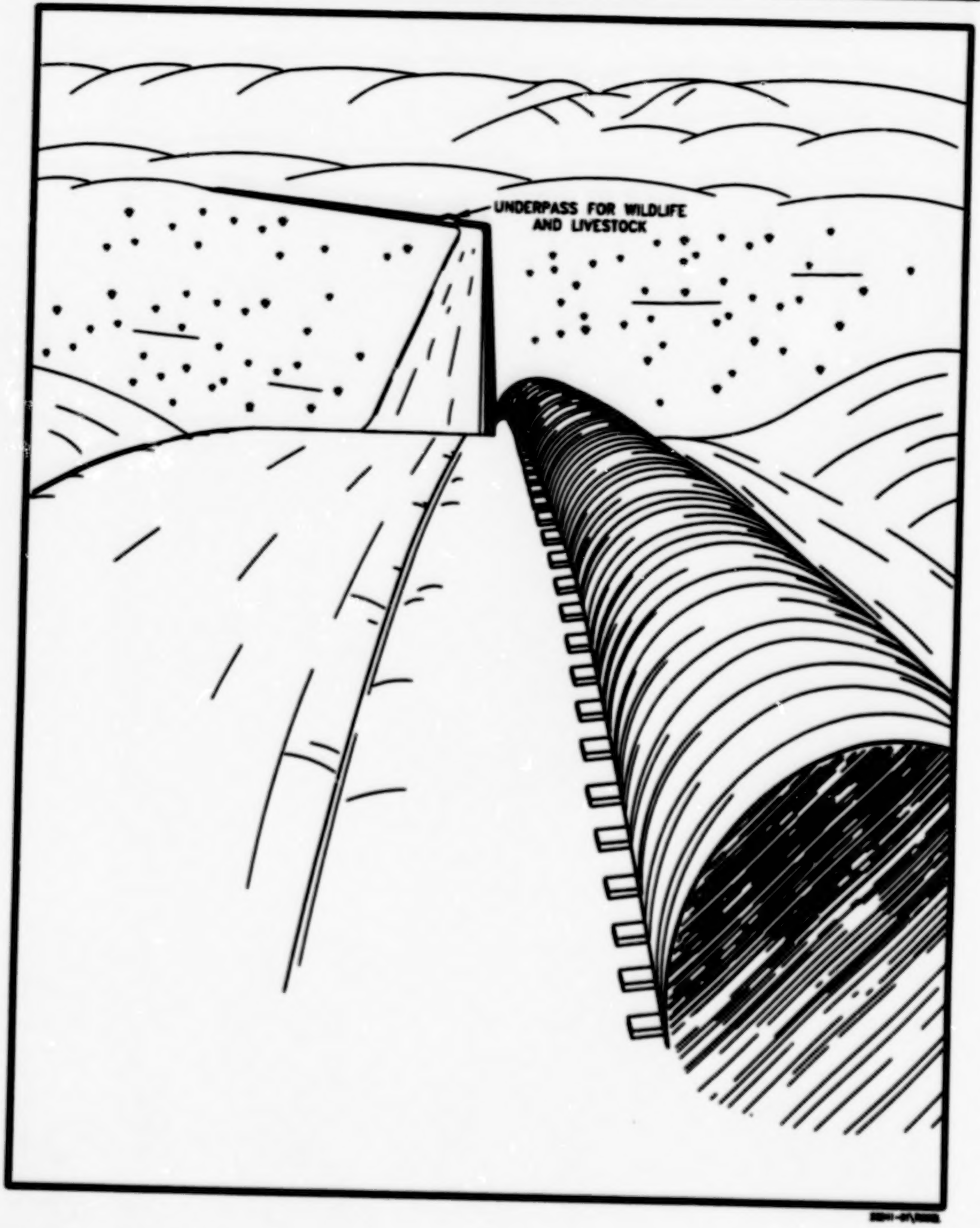
UNDERPASS FOR WILDLIFE AND LIVESTOCK

Figure 2.7 Schematic Diagram of Conveyor.

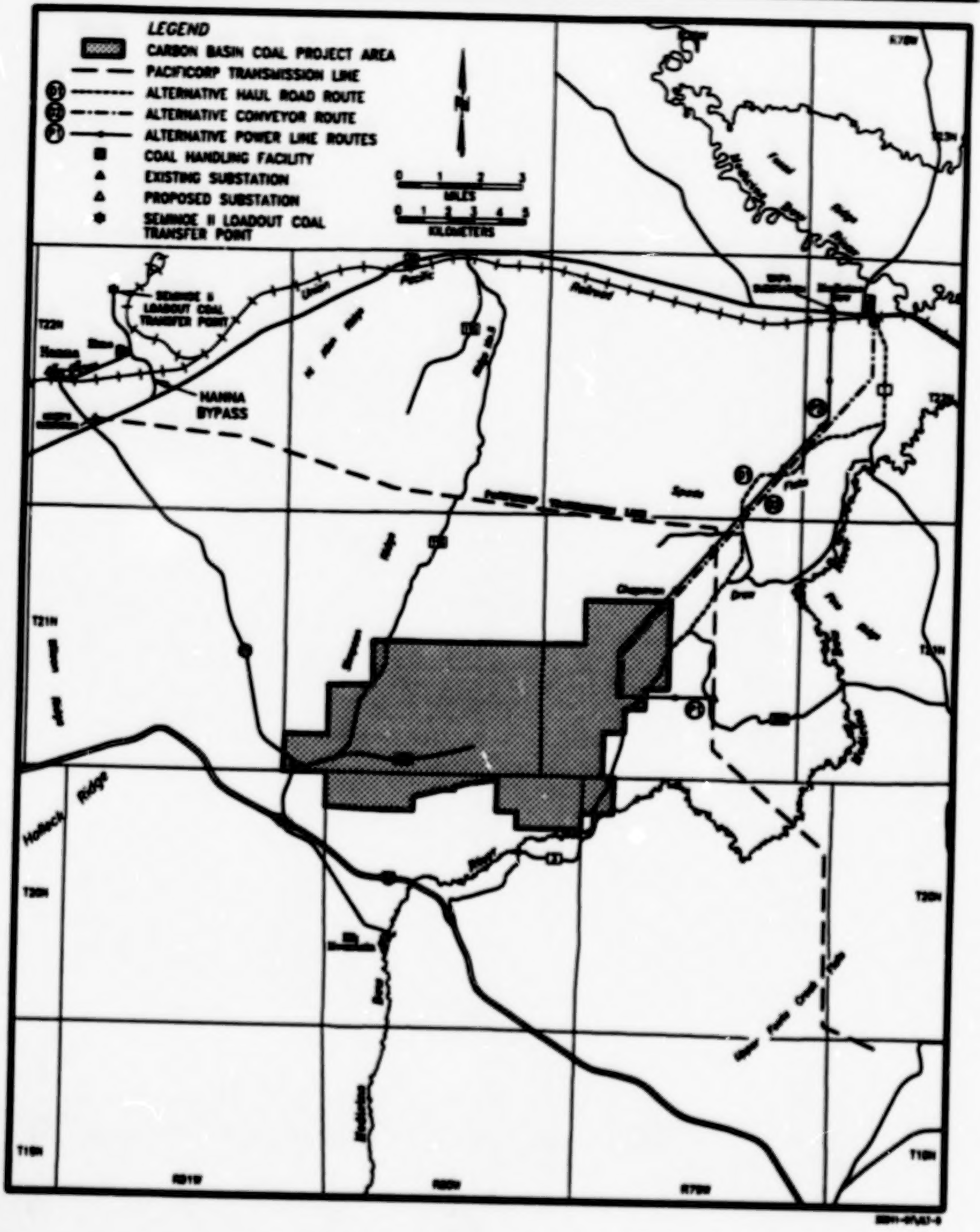
LEGEND
CARBON BASIN COAL PROJECT AREA
PACIFICORP TRANSMISSION LINE
ALTERNATIVE HAUL ROAD ROUTE
ALTERNATIVE CONVEYOR ROUTE
ALTERNATIVE POWER LINE ROUTES
COAL HANDLING FACILITY
EXISTING SUBSTATION
PROPOSED SUBSTATION
SEMINOE II LOADOUT COAL TRANSFER POINT
N
0 1 2 3
MILES
0 1 2 3 4 5
KILOMETERS
SEMINOE II LOADOUT COAL TRANSFER POINT
Union
Pacific
Railroad
HANNA BYPASS
Hanna
Chapman
Hallock Ridge
T22N
T21N
T20N
T19N
R79W
R81W
R80W

Figure 2.8 No Railroad with Haul Road or Conveyor, Transportation Options 9 and 10.

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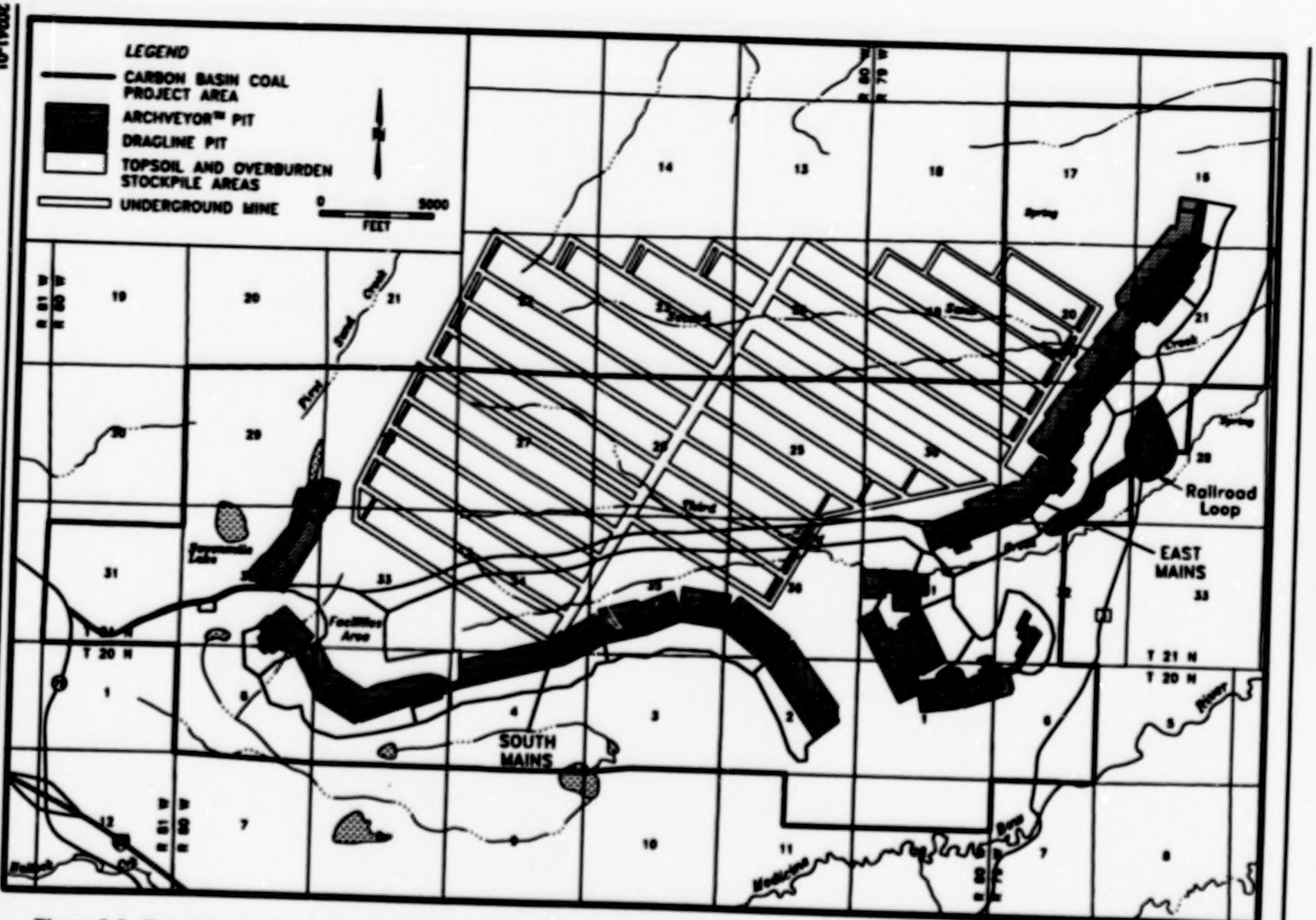

Figure 2.9 Generalized Mining Plan, Elk Mountain and Saddleback Hills Mines.

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Table 2.12 Estimated LOM Soil/Overburden Mass Balance and Production Rate, Proposed Action.

	Topsoil (thousand cu yd)[1]			Overburden (thousand cu yd)				Coal Mined (million tons)		
Year	Stripped	Replaced	In Stockpiles[2]	Stripped	Backfilled	In Stockpiles[2]	Regraded	Surface	Underground	Total
1999	25	0	25	0	0	0	0	0	0	0
2000	981	0	1,006	12,506	6,804	5,702	0	1.279	0	1.279
2001	636	0	1,642	15,067	8,197	12,572	0	2.976	0	2.976
2002	745	0	2,387	15,821	8,607	19,786	0	3.413	0	3.413
2003	555	453	2,489	16,412	8,929	20,922	6,347	3.083	0	3.083
2004	737	649	2,577	12,828	6,979	19,617	7,154	4.051	0.300	4.351
2005	590	598	2,569	15,321	8,335	19,182	7,421	4.327	0.990	5.317
2006	588	588	2,569	14,766	8,033	18,201	7,714	3.346	1.169	4.515
2007	716	662	2,623	14,414	7,842	17,380	7,393	3.106	3.658	6.764
2008	413	636	2,400	14,013	7,624	16,207	7,562	1.965	4.522	6.487
2009	507	625	2,282	13,673	7,439	18,348	4,093	2.326	5.387	7.713
2010	20	491	1,811	1,944	1,058	13,526	5,708	1.228	6.322	7.550
2011	0	365	1,446	0	0	8,194	5,332	0	6.311	6.311
2012	0	435	1,011	0	0	1,164	7,030	0	6.596	6.596
2013	0	237	774	0	0	0	1,164	0	6.596	6.596
2014	0	0	774	0	0	0	0	0	6.596	6.596
2015	0	0	774	0	0	0	0	0	6.596	6.596
2016	0	0	774	0	0	0	0	0	6.596	6.596
2017	0	0	774	0	0	0	0	0	6.596	6.596
2018	0	0	774	0	0	0	0	0	6.596	6.596
2019	0	0	774	0	0	0	0	0	6.596	6.596
2020	0	0	774	0	0	0	0	0	6.596	6.596
2021	0	464	310	0	0	0	0	0	0	0
2022	0	232	232	0	0	0	0	0	0	0
2023	0	78	0	0	0	0	0	0	0	0
Total	6,513	6,513	–	146,765	79,847	–	66,918	31.109	88.023	119.123

[1] Volumes of topsoil reported in this table do not include topsoil salvaged for railroad construction in 2004 or for railroad reclamation in 2021, 2022, and 2023.

[2] Cumulative amounts stored in stockpiles. Some topsoil and overburden would be directly backhauled, so stripped minus replaced and stripped minus backfilled do not equal the amount in stockpiles.

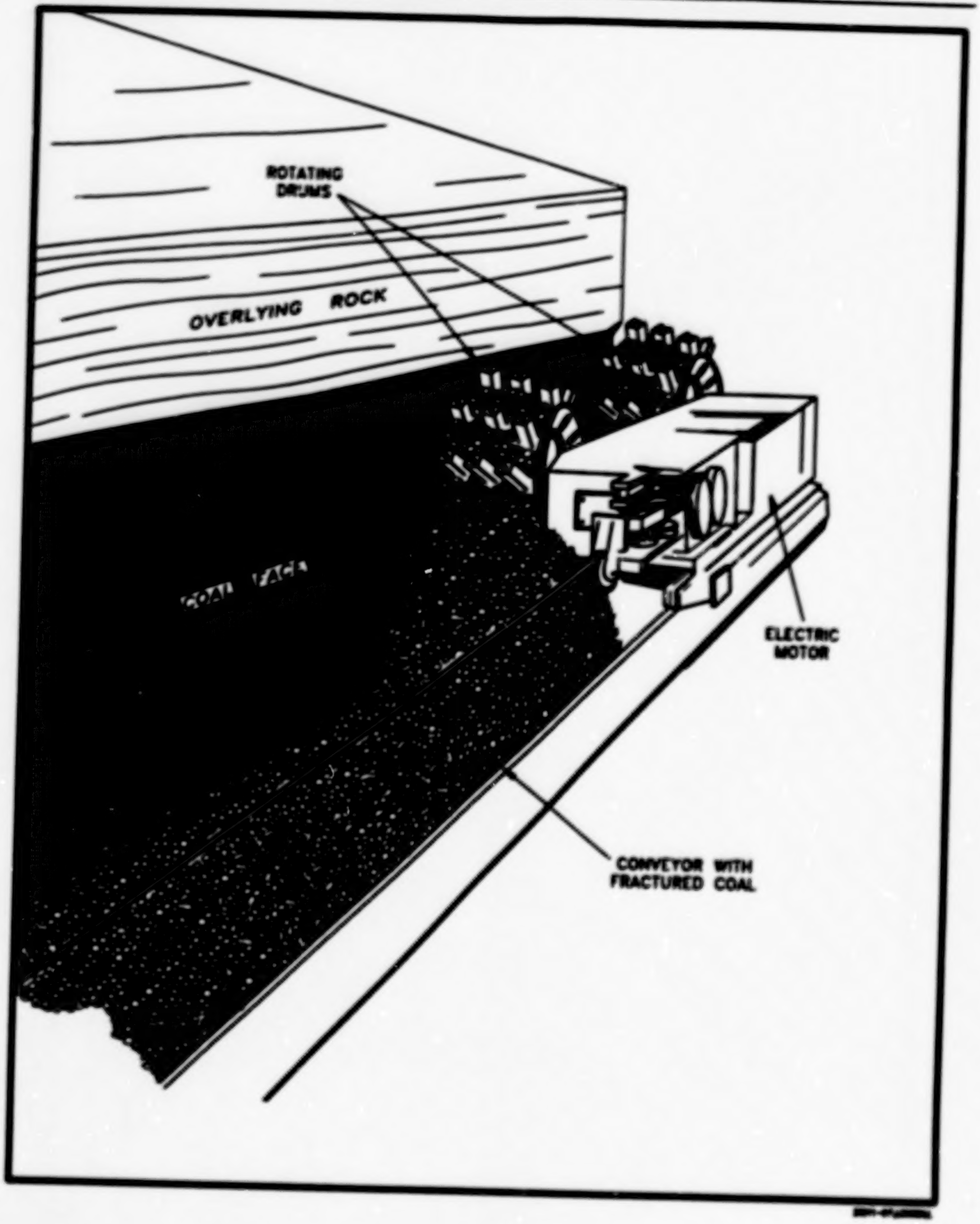

Figure 2.10 Schematic Diagram of Longwall Mining System.

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(2003), main entries (the South Mains) would be cut in sec. 34, T.20 N., R.80 W. (Figure 2.9). During the second year, additional main entries (the East Mains) would be cut in sec. 29, T.21 N., R.79 W. The South and East Mains would intersect underground in sec. 24, T.21 N., R.80 W.

Main entries would be cut using continuous mining machines equipped with rotating drums with bits that cut coal directly from an exposed coal face and load it on to a conveyor or into shuttle cars, which haul it to a conveyor. Main entries would be initiated at the base of the highwalls exposed by surface mining and would follow the Johnson Seam down to approximately 600-800 ft, where most underground mining would occur. The East and South Mains would be approximately 2.0 mi and 3.3 mi long, respectively, and approximately 18 ft wide and 10 ft high, respectively.

The continuous miners would then cut around blocks (referred to as panels) of underground coal (Figure 2.11). Each panel would be approximately 1,000 ft wide and 10,000 ft long. Once the South and East Mains intersect (in sec. 24, T.21 N., R.80 W.) and the first few panels have been developed, a longwall mining system would be installed at the western end of the southwesternmost panel.

While the continuous miners continue to develop longwall panels, the longwall mining system would mine from the exposed coal face of each panel. The longwall mining system would be equipped with a shearer that has two rotating drums for cutting coal, a self-advancing hydraulic roof support system, and a conveyor to transport coal. The rotating drums would move down and up along the coal face, cutting approximately 18 inches with each pass. The hydraulic roof support system would automatically move towards the receding coal face, and the roof would be allowed to cave into mined-out areas. Cut coal would fall onto a chain conveyor to be transported to a tailgate conveyor and up to the ground surface via the east mains, where it would be temporarily stockpiled in a storage barn. For panels on the western side of the mine, mining would occur from west to east along the coal face. At the end of each pass, the drum and roof support system would be walked back to the western end for another pass. This pattern would be reversed on the eastern side.

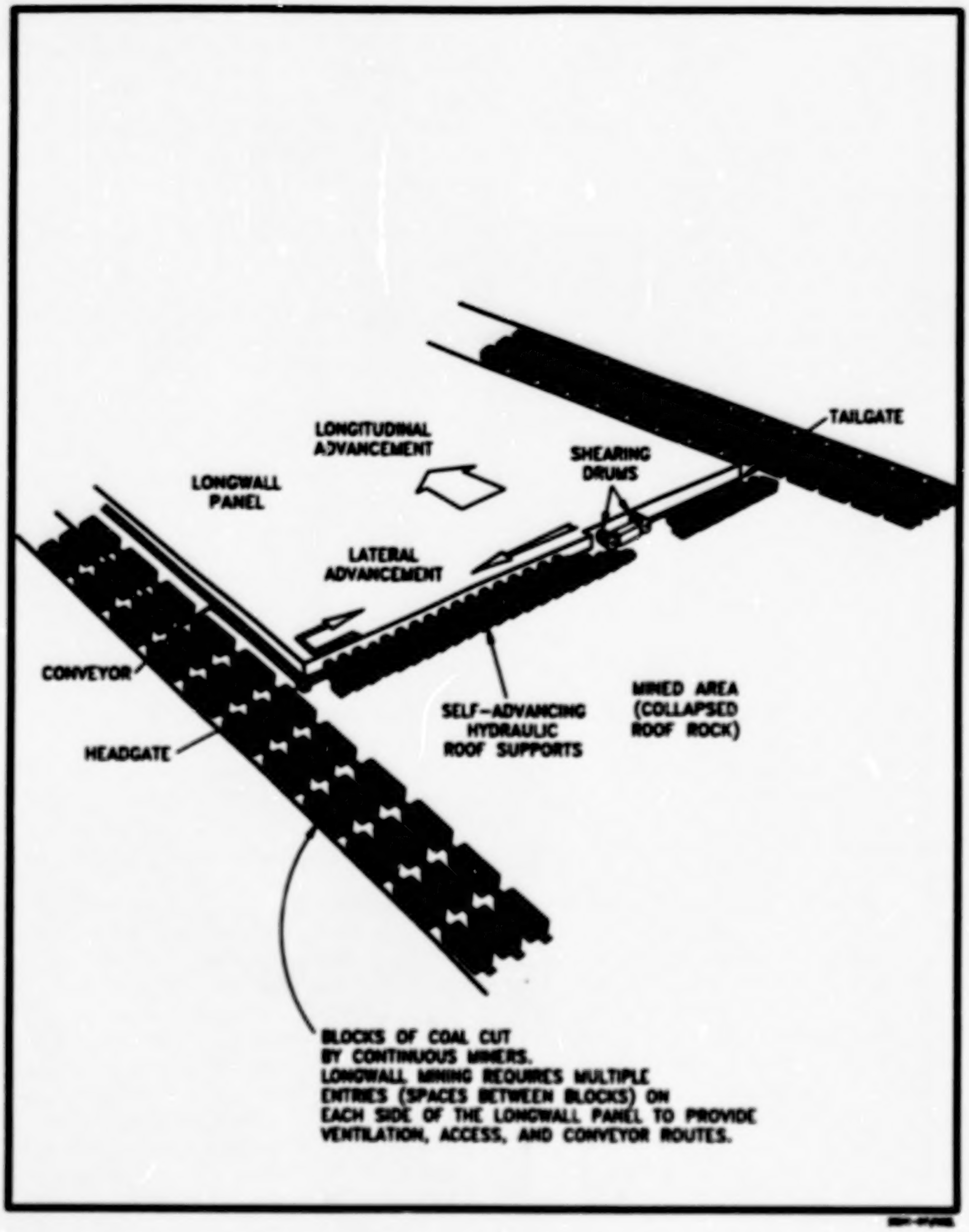
The underground mine would be ventilated with exhaust fans along the portals and vertical air shafts located on the South and East Mains.

At the coal-handling facility, raw coal would be dumped into storage barns or a hopper in a crushing building, where the coal would be sized to 2 inches and then conveyed to storage silos or to a tipple equipped with an automatic sampling system and scales. Coal would be loaded into railcars from the tipple. The entire facility would be fully enclosed to minimize fugitive dust emissions.

Estimated production rates for the underground mine would range from 0.3 to 6.6 million tons per year (Table 2.12). Total production from combined surface and underground operations would range from 1.3 to 7.7 million tons per year.

2.2.4.2 Required Equipment and Facilities

In addition to the equipment and facilities required for surface mining described for the No Action Alternative, the underground mine would require a longwall mining system (including a continuous miner, hydraulic roof support shields, and conveyors); a coal-handling facility (including a hopper, a crusher, two 20,000-ton silos [each approximately 217 ft tall], a conveyor, an automatic sampling system, a scale, and three 150,000-ton storage barns for raw coal storage) (Table 2.13). Two portable substations would be used to serve the longwall mining system and the new coal-handling facility.



BLOCKS OF COAL CUT BY CONTINUOUS MINERS. LONGWALL MINING REQUIRES MULTIPLE ENTRIES (SPACES BETWEEN BLOCKS) ON EACH SIDE OF THE LONGWALL PANEL TO PROVIDE VENTILATION, ACCESS, AND CONVEYOR ROUTES.

Figure 2.11 Underground Coal Panels and Longwall Mining System.

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Table 2.13 Estimated LOM Equipment Requirements, Elk Mountain and Saddleback Hills Mines, Proposed Action.

Year	Archveyors[1]	Draglines	Drills	Dozers	Loaders	200-ton Haul Trucks	End Dump Trucks	Scrapers	Graders	Water Trucks	Utility Trucks	Reclamation Equipment[2]
Elk Mountain Mine												
1999	0	0	0	4	0	0	2	5	2	2		
2000	0	1	2	[illegible]	4	5	2	5	4	2	0	0
2001	1	1	2	8	4	5	2	5	3	2	21	5
2002	1	1	2	8	4	5	2	5	3	2	21	5
2003	1	1	2	8	4	5	2	5	3	2	21	5
2004	1	1	2	8	4	5	2	10	4	2	21	5
2005	1	1	2	8	4	5	2	5	3	2	21	5
2006	1	1	2	8	4	5	2	5	3	2	21	5
2007	1	1	2	8	4	5	2	5	3	2	21	5
2008	1	1	2	8	4	5	2	5	3	2	21	5
2009	1	1	2	8	4	5	2	5	3	2	21	5
2010	1	1	0	5	3	2	2	5	3	2	21	5
2011	1	0	0	5	2	2	2	5	3	1	4	5
2012	0	0	0	5	2	2	2	5	2	1	3	5
2013	0	0	0	5	1	0	2	5	2	1	3	5
2014	0	0	0	5	1	0	2	5	2	0	3	5
2015	0	0	0	5	0	0	2	0	1	0	2	5
2016	0	0	0	5	0	0	2	0	1	0	2	5
2017	0	0	0	5	0	0	2	0	1	0	2	5
2018	0	0	0	5	0	0	2	0	1	0	2	5
2019	0	0	0	5	0	0	2	0	1	0	2	5
2020	0	0	0	5	0	0	2	0	1	0	2	5
2021	0	0	0	4	0	0	2	0	1	0	2	5
2022	0	0	0	4	0	0	2	5	2	0	2	5
2023	0	0	0	4	0	0	2	5	2	0	2	5

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Table 2.13 (Continued)

Year	Continuous Miner[2]	Shuttle Car[3]	Roof Bolter[4]	Longwall Shearer[5]	Longwall Shields[6]	Scoops[7]	Mantrips[8]	Graders[9]	Locomotives	Railcars	Utility Vehicles[10]
Saddleback Hills Mine[11]											
1999	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0
2001	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0	0
2003	0	0	0	0	0	0	0	0	0	0	0
2004	1	1	1	0	6	1	6	1	0	0	3
2005	3	8	3	0	0	3	6	1	0	0	12
2006	3	8	3	0	0	3	6	1	4	150	12
2007-2020	3	8	2	1	180	3	6	1	4	150	12

[1] Includes one ripper, one discer, one seeder, one mulcher, and one pickup truck.
[2] Used to make portal entries and cut panels of coal for the longwall.
[3] Used to transport coal from continuous miners to conveyors.
[4] Used to install roof support for the underground mine.
[5] Shears coal from cut panels.
[6] Supports roof of underground mine during shearing.
[7] Small hydraulic loader used underground.
[8] Pickup trucks or tractors for transporting personnel.
[9] Used to grade haulage ways underground.
[10] Welding trucks, fuel trucks, mechanics trucks, etc.
[11] Reclamation equipment is included in equipment list for the Elk Mountain Mine.

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2.2.4.3 Topsoil and Mine Rock Management

Topsoil and mine rock from the surface mine would be managed as described for the No Action Alternative. Estimated overburden thickness ranges from 0 to 250 ft. Based on an average thickness of 118 ft, approximately 146,765,000 cu yd of overburden would be stripped during the LOM (see Table 2.12). Approximately 79,846,000 cu yd would be backhauled or back-cast directly from the advancing pit into mined-out areas to avoid repeated handling. Stockpiling of up to 20,922,000 cu yd at any one time would be necessary due to pit turns and variations in the volume of overburden removed. Any topsoil or overburden material that is deemed unsuitable for reclamation would be stockpiled separately and buried according to BLM and WDEQ requirements as mined-out areas are backfilled.

Direct surface disturbance due to underground mining would be caused by transportation corridor and coal-handling facility construction; all other surface disturbance from underground mining would occur in areas previously disturbed by surface mining. Topsoil would be salvaged prior to construction of any of the transportation options and stockpiled for use during reclamation. Since underground mining methods target coal reserves with minimal disturbance of other strata, there would be little additional mine rock to handle and stockpile. Rock encountered in partings within the coal seams would be disposed of in areas created during surface mining. Indirect surface disturbance caused by subsidence would be limited to occasional surface cracks and the creation of a low-relief basin and ridge topography (see Section 4.1.5). Surface cracks are unlikely to occur, and if they do, they would be limited in areal extent and would be reclaimed immediately with no topsoil or rock management necessary.

2.2.4.4 Mine-Water Discharge and Treatment

Excess mine water from the surface mine would be discharged and treated as described for the No Action Alternative. Excess water from the underground mine would be pumped into WDEQ-approved sedimentation ponds where water would be evaporated or it would be discharged directly to the surface (into channels or ditches) in accordance with the National Pollutant Discharge Elimination System permit.

2.2.4.5 Water Requirements

Water requirements for the surface mine would be as described for the No Action Alternative. After commencement of underground mining, water requirements would be from 123,000 to 126,000 gallons per day, primarily for operation of the new coal-handling facility, the continuous miners, and the longwall mining system (Table 2.6).

2.2.5 Railroad and Conveyor Construction

The following section describes standard methods used to construct a railroad or a conveyor if these transportation options are approved. If haul road transportation options are approved, haul roads would be constructed as described in Section 2.1.4 for the No Action Alternative.

2.2.5.1 Railroad Construction

The two railroad routes shown on Figure 2.4 were examined by Union Pacific Railroad Company in the early 1980s (Figure 2.4) to service the proposed, but never developed, Edison Development Mine (Union Pacific Railroad Company, n.d. unpublished map). One of these two routes could be developed if the railroad becomes an approved transportation option.

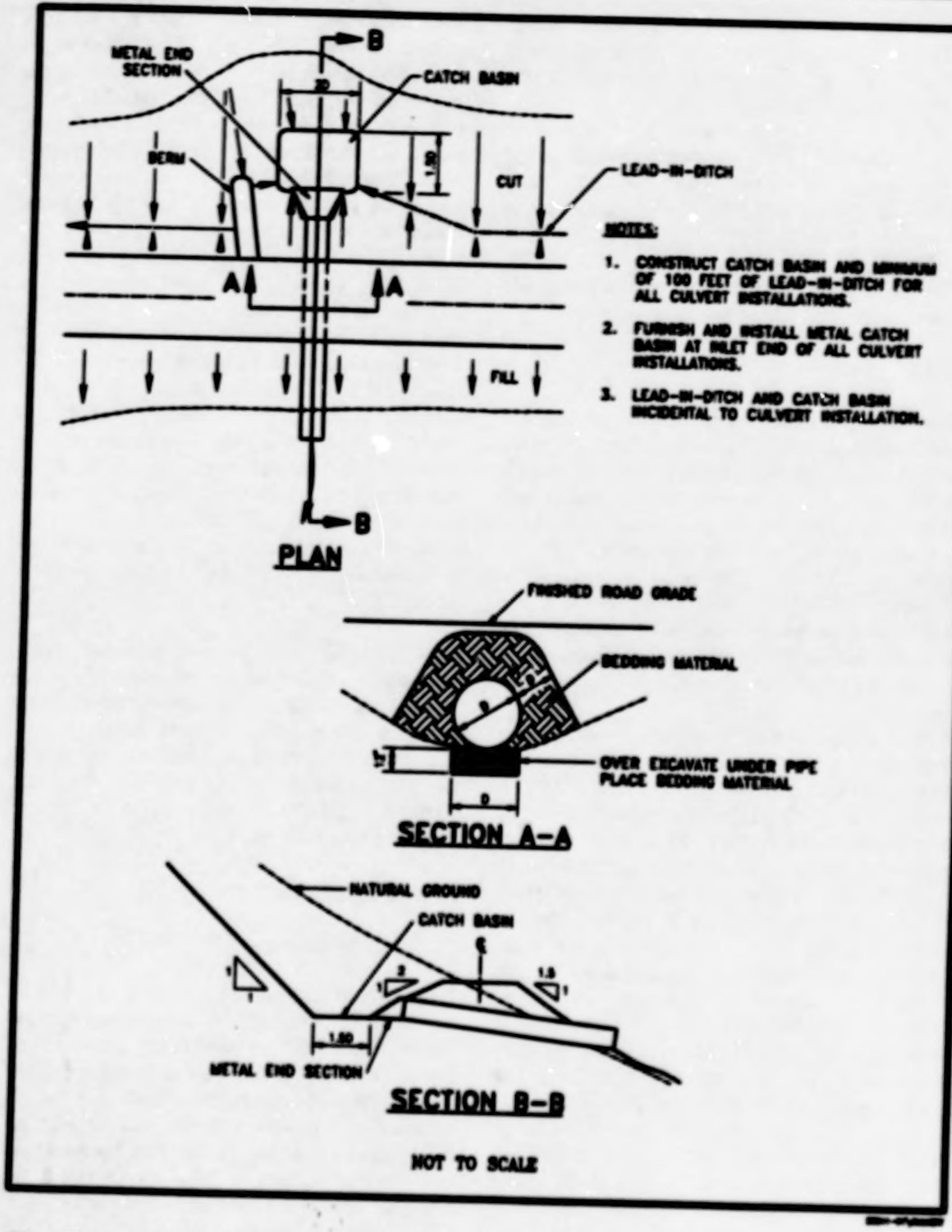
Railroad construction would involve standard cut-and-fill procedures to develop the grade, placement of subballast (e.g., No. 57 gravel) along the grade, tie and plate placement, and spiking the rails. Railroad construction equipment is listed in Table 2.14. Once the rails have been spiked, 4- to 6-inch ballast would be dumped over the rail. A tamper would be used to raise the track and ties and tamp ballast beneath the ties (Table 2.14). Ballast would then be brushed level with ties using a ballast regulator. The finished grade would be 14 ft wide with 5 ft shoulders, for a total width of 24 ft.

The railroad would be 12.4-13.2 mi long, depending on the route selected. Assuming a construction disturbance width of 160 ft, initial disturbance would be up to 256 acres. Approximately 80 ft on either side of the railroad would be reclaimed immediately after construction, so LOM disturbance would be up to 128 acres.

Regardless of the route selected, the railroad would cross Second Sand Creek and Chapman Draw, as well as county and local roads. Stream crossings would be completed using practices such that impacts to these streams are minimal. Figure 2.12 shows typical details of culvert installation for ephemeral streams. The western route would cross County Road 3 (see Figure 2.4) three times. An additional three unmaintained roads and one pipeline would also be crossed. The eastern route would cross County Road 3 twice and the Medicine Bow-Arlington County Road 1 once. Other crossings would include eight minor roads, one power line, and one pipeline.

Table 2.14 List of Equipment Typically Used for Railroad and Conveyor Construction.

Equipment	Function
Railroad Construction	
Dozer	Remove vegetation from staging areas and along selected portions of the ROW to improve access; grade ROW
Scrapers	Grade ROW
Over-the-road trucks	Haul gravel, ballast, rail, ties, and other equipment
Railcars	Haul gravel and ballast
Ballast regulator	Spreads ballast flush with ties and creates shoulders
Tamper	Lift assembled rail up through ballast and tamp ballast
Air-powered jet hammers	Spike rail
Conveyor Construction	
Dozer	Remove vegetation and grade ROW
Scrapers	Grade ROW
Over-the-road trucks	Haul gravel for roadbed, railroad ties, frames, covers, etc.
Backhoe	Transfer anchor point and electrical cable trench excavation
Concrete trucks	Mixing, hauling, and pouring concrete
Cable stringer	Stringing suspension and electrical cables
Welders	Welding steel frames



NOTES:

1. CONSTRUCT CATCH BASIN AND MINIMUM OF 100 FEET OF LEAD-IN-DITCH FOR ALL CULVERT INSTALLATIONS.
2. FURNISH AND INSTALL METAL CATCH BASIN AT INLET END OF ALL CULVERT INSTALLATIONS.
3. LEAD-IN-DITCH AND CATCH BASIN INCIDENTAL TO CULVERT INSTALLATION.

Figure 2.12 **Typical Culvert Installation for Crossings of Ephemeral Streams.**

All roads would be crossed with at-grade crossings (Figure 2.13). Approximately 0.75 mi of County Road 3 would be temporarily relocated in the vicinity of the proposed rail loop.

Final clean-up and restoration would occur immediately following construction. Waste materials (e.g., brush, rock, construction materials) would be removed from the area and recycled or disposed of at approved facilities. Revegetation of scalped or cleared areas would occur in the first fall following construction.

2.2.5.2 Conveyor Construction

The conveyor would be constructed in sections, each approximately 2000 ft long, each of which would contain its own conveyor belt and electric drive system. Conveyor construction would involve initial grading and possibly development of a road base along a corridor approximately 50 feet wide to create a relatively flat surface for conveyor and access road construction. The access road would be constructed in accordance with the road standards described in Section 2.1.4 for the No Action Alternative.

After grading and road base development, transfer and anchor points for each section of the conveyor would be excavated at approximately 2,000-ft intervals using a backhoe. Excavations would be approximately 10 ft deep and 3 ft in diameter, filled with concrete; anchor bolts would be set in the concrete. A 1 ft wide by 3 ft deep trench would be excavated using a backhoe and an electrical cable would be installed to serve the conveyor drive assemblies (one assembly for each section) Railroad ties would be placed perpendicular to the conveyor corridor at approximately 15 ft intervals and possibly anchored to the ground with rebar, although anchoring is not typically necessary.

After the anchor and transfer points have been constructed, suspension cable would be strung along each section of the conveyor using a cable stringer. Steel frames would be bolted to the railroad ties, and rollers (idlers) would be mounted on the steel frames. A drive assembly (e.g., electric motor, gear box) would be installed at one end of each section and wired to the underground cable. The belt would then be installed on top of the rollers, and the conveyor would be covered with a light-weight corrugated steel quonset-type cover.

Underpasses or overpasses would be constructed at intervals to be determined in consultation with Wyoming Game and Fish Department (WGFD) and at all road crossings to allow passage of wildlife, livestock, and vehicles. Underpasses would be constructed by elevating the conveyor on a tall (e.g., 8-12 ft) steel framework or by excavating a path under the conveyor. Overpasses would consist of earthen ramps at least 20 ft wide, similar to the types used at an underground mine in Colorado in the late 1980s/early 1990s (Chervick 1991).

Final clean-up and restoration would occur immediately following construction. Waste materials (e.g. brush, rock, construction materials would be removed from the area and recycled or disposed of at approved facilities. Revegetation of any areas disturbed during construction but not needed for operations would occur in the first fall following construction.

2.2.6 Transportation and Traffic

2.2.6.1 Transportation

Ten transportation options are being evaluated as part of the Proposed Action. During construction, existing roads would be used to the greatest extent possible to transport materials and equipment from storage yards to construction areas and for all maintenance activities. No new road construction is anticipated for the power line, railroad, or coal-handling facility. New roads would be required for the haul road and conveyor options.

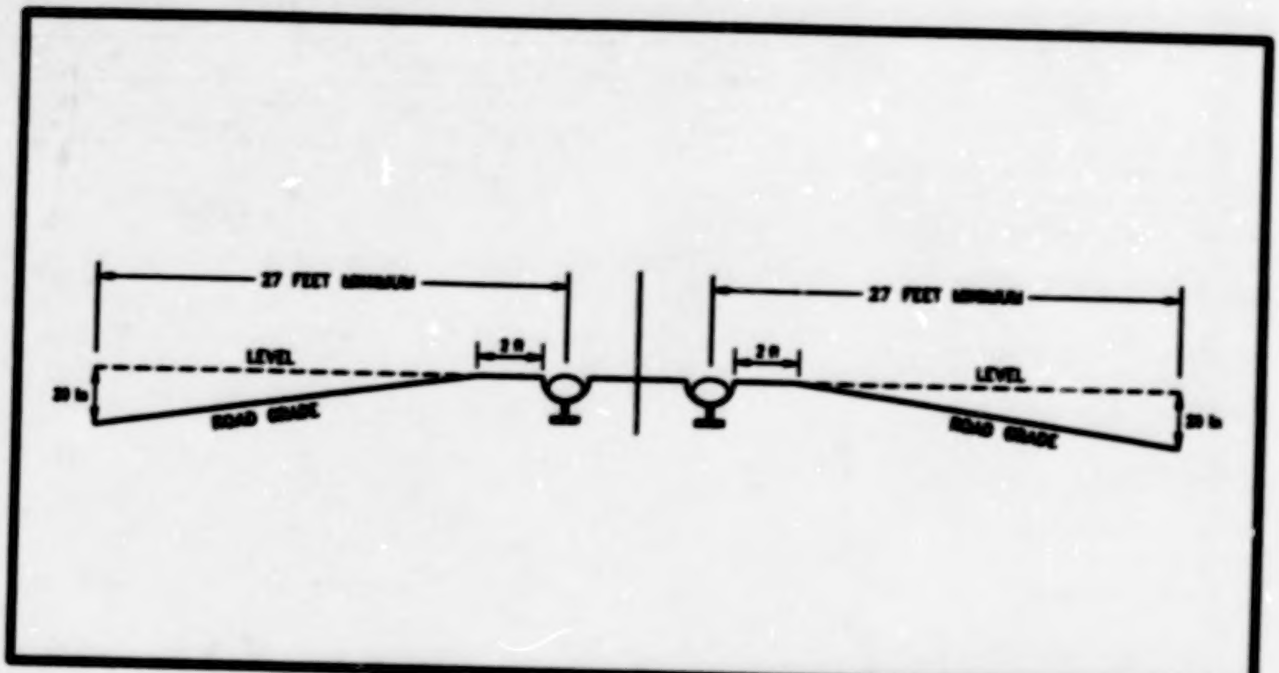


Figure 2.13 **Typical At-grade Crossing of County and Local Roads.**

2.2.6.2 Traffic

Construction Traffic. Construction of mine roads, facilities, the dragline, and the Archveyor™ would occur simultaneously using single vehicles for multiple tasks. The average number of daily vehicle trips to and from the mine site would be approximately 160 vehicles per day during the period from October 1999 to February 2000 (Table 2.15). Most vehicles traveling to the mine during construction would be pickup trucks, although approximately five trips per day would be large trucks (e.g., tractor-trailers) hauling equipment (e.g., pieces of the dragline).

Underground mine development would require 34-168 trips per day by cars and pickups. The continuous miners, longwall mining system, and other heavy equipment (e.g., shields, shuttle cars, conveyors) would be hauled to the site on tractor-trailers which would total approximately 18-20 trips per day. An estimated 42-164 trips per day, over-and-above the truck traffic associated with the surface mine, would be made by over-the-road trucks hauling coal while the railroad is being constructed. An estimated 122 vehicle trips per day (tractor-trailers and pickup trucks) would be required during railroad construction (Table 2.15).

Operation and Reclamation Traffic. Employee and vendor traffic (cars and pickups) would range from approximately 34 trips per day during the first several years of mining to 176 trips per day during peak production. An additional 30 trips per day would be required for initial and interim reclamation. Mine closure and reclamation would require approximately 40 trips per day. Most employees would commute from Hanna via Highway 72 or from Medicine Bow via a county road or from Laramie and Rawlins via I-80 (see

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Table 2.15 Estimated Mine-Related Traffic, Proposed Action.

Activity	Estimated Time Frame	No. Days	Average Daily Traffic on Public Roads			
			Cars/ Pickups	Coal Haul Trucks	Other Large Trucks	All Vehicles Combined
Initial construction (haul road, access roads, facilities, power line)	Oct 1999- Feb 2000	80	150	0	10[1]	160
Surface mine operations	Jan 2000- Dec 2010	3,550[2]	34-168	0	18-20[3]	52-188
Underground facilities development	Jan 2004- Dec 2005	710	42-172	0	18-20[3]	60-192
Underground mine operations	Jan 2006- Dec 2020	4,970	82-176	0	18-20[3]	100-196
Initial and interim reclamation	Sep 2000- Dec 2020	1,260[4]	30	0	6	36
Final reclamation	Dec 2020- Dec 2023	180[5]	40	0	6	46
Transportation Options						
Options 1 and 2						
Over-the-road haulage	Jan 2000- Dec 2005	1,775	108-120	222-900	0	330-1,020
Railroad and coal-handling facility construction	Jan 2004- Jun 2004	80	116	0	6	122
Railroad and coal-handling facility operations	Jul 2004- Dec 2020	7,455	14	0	0	14
Railroad and coal-handling facility reclamation	Jan 2021- Dec 2023	40	40	0	2	42
Option 3						
Railroad and coal-handling facility construction	Oct 1999- Feb 2000	80	116	0	6	122
Railroad and coal-handling facility operations	Mar 2000- Dec 2020	7,395	14	0	0	14
Railroad and coal-handling facility reclamation	Jan 2021- Dec 2023	40	40	0	2	42
Option 4, 5, and 6[7]						
Haul road construction	Oct 1999- Feb 2000	80	104	0	6	110
Hauling during operations	Mar 2000- Dec 2004[6]	1,715	9-30	23-136	0	32-166
Haul road reclamation	Jan 2005- Dec 2008	40	40	0	0	40
Railroad and coal-handling facility construction	Jan 2004- Jun 2004	80	116	0	6	122
Railroad and coal-handling facility operation	Jul 2004- Dec 2020	7,455	14	0	0	14
Railroad and coal-handling facility reclamation	Jan 2021- Dec 2023	40	40	0	2	42

Table 2.15 (Continued)

Activity	Estimated Time Frame	No. Days	Average Daily Traffic			
			Cars/ Pickups	Coal Haul Trucks	Other Large Trucks	All Vehicles Combined
Transportation Options (cont.)						
Options 7 and 8						
Conveyor construction	Oct 1999- Feb 2000	80	40	0	5-6	45-46
Conveyor operation	Mar 2000- Dec 2004[6]	1,715	24	0	0	24
Conveyor reclamation	Jan 2005[6]- Dec 2008	40	40	0	0	40
Railroad and coal-handling facility construction	Jan 2004- Jun 2004	80	116	0	6	122
Railroad and coal-handling facility operation	Jul 2004[6]- Dec 2020	7,455	14	0	0	14
Railroad and coal-handling facility reclamation	Jan 2021- Dec 2023	40	40	0	2	42
Options 9 and 10						
Haul road construction	Oct 1999- Feb 2000	80	104	0	6	110
Hauling during operations	Mar 2000- Dec 2020	7,395	9-30	23-136[7]	0	32-166
Haul road reclamation	Jan 2021- Dec 2023	40	40	0	0	40
Conveyor construction	Oct 1999- Feb 2000	80	40	0	5-6	45-46
Conveyor operation	Mar 2000- Dec 2020	7,395	24	0	0	24
Conveyor reclamation	Jan 2021- Dec 2023	40	40	0	2	42
Coal-handling facility construction	Oct 1999- Feb 2000	80	40	0	2	42
Coal-handling facility operation	Mar 2000- Dec 2020	7,395	12	0	0	12
Coal-handling facility reclamation	Jan 2021- Dec 2023	40	40	0	2	42

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[1] Includes two trips per day for water trucks for dust suppression during construction.

[2] Assumes that the mines would operate 255 days per year.

[3] Includes four trips per day for water trucks to supply water for equipment washing, showers, and sanitary facilities.

[4] Assumes that reclamation would occur 60 days/year for 21 years.

[5] Assumes that reclamation would occur 60 days/year for 3 years.

[6] The date for transition from hauling by truck or conveyor to hauling by conveyor may be late-2004 to mid-2005; dates listed in this table are approximate. Furthermore, there would be some overlap, where both haulage methods would be used, during the transition.

[7] 200-ton haul trucks would be primarily on an exclusive use haul road, not on public roads, except where they cross public roads and on the Hanna Bypass.

[8] Under Option 9, the haul road option, only.

Section 3.4), so traffic would be distributed on several different roads.

Large trucks (e.g., tractor-trailers) would make approximately 18-20 daily trips to and from the mine during operation to deliver equipment and bulk supplies (e.g., explosives). If Arch is unable to develop an on-site water source, two 5,000-gallon water trucks would make an average of two trips per day for a total of four trips per day. Snow removal equipment would be utilized as needed during winter.

Average daily traffic would be highest under transportation options 1 and 2 because over-the-road haul traffic would create 222-900 trips per day (Table 2.15). Average daily traffic associated with coal transportation would be lowest with railroad and coal-handling facility operations (14 vehicles per day). Haul road operations would require an estimated 9-30 vehicles per day, and conveyor operations would require approximately 24 vehicles per day. Construction traffic for all transportation options would be between 45 and 122 vehicles per day. Reclamation traffic would be between 40 and 42 vehicles per day.

2.2.7 Employment and Employee Access

An estimated 43-114 employees and contractors would be required during the first 2 years of mine development for road, power line, and facilities construction and dragline assembly (Table 2.16). Once the infrastructure has been developed, surface mine operations would require approximately 24 employees on each of three 8-hour shifts per day (total of 72 employees) plus an additional 26 staff for the LOM. Most employees would be transferred from the Seminoe II and Medicine Bow Mines, which are in the final years of production; this would enable Arch to avoid major layoffs associated with mine closure. Arch currently employs approximately 90 operators and staff, and by the third year of mine development, there would be enough jobs at the new mine to continue this employment. Arch would use local contractors, whenever feasible.

During development of the underground mine (2004-2005), approximately 36 employees and 80 contractors would be required to install the longwall mining system and two additional electrical substations and construct the railroad and coal-handling facility (Table 2.16). Underground mining would occur simultaneously with surface mining, so for a period of approximately 11 years (when surface mining would cease), underground and surface mine operations would require up to 297 employees. After the cessation of surface mining, underground mining would continue to employ 210 personnel for the LOM. Even if all employees choose to transfer to the proposed new mines, mine development would create approximately 89-207 new jobs from 2004 to 2020 (17 years). Transportation option construction, operations, maintenance, and reclamation would require additional employees and contractors (Table 2.17). Arch would use local contractors whenever feasible.

2.2.8 Public Access and Safety

As with the No Action Alternative, haul truck traffic on Highway 72 (except to serve local customers) would be halted when school buses are transporting children on the highway. Under transportation options 1 and 2, haul truck traffic on Highway 72 would be eliminated after 3 to 5 years of mining, when the rail spur would become operational. Arch would discontinue hauling coal via Highway 72; some warning signs would be retained (e.g., Trucks Entering Highway) to warn motorists of potential heavy truck traffic associated with deliveries, but other signs would be removed, and the highway would be restored to a condition as good as or better than premining conditions. Under the other transportation options, Highway 72 would not be used to haul coal (except as currently done for local customers) during the LOM.

The railroad, haul road, and conveyor corridors would cross county and local roads at numerous locations, depending on the route selected. Warning signs would be posted at these crossings

Table 2.16 Predicted LOM Employment Requirements, Proposed Action.

Year	Coal Production Year	Surface Operators	Underground Operators	Construction Employees	Staff	Employee Total	Contractors	Total
1999	0	0	0	21	0	21	22[1]	43
2000	1	38	0	18	22	78	36[1]	114
2001	2	59	0	8	26	93	7[2]	100
2002	3	59	0	0	26	85	7[2]	92
2003	4	72	0	0	26	98	7[2]	105
2004	5	72	21	36	32	215	80[2]	295
2005	6	72	58	36	43	209	80[2]	289
2006	7	72	86	0	55	213	7[2]	220
2007	8	72	164	0	61	297	7[2]	304
2008	9	72	164	0	61	297	7[2]	304
2009	10	72	164	0	61	297	7[2]	304
2010	11	72	164	0	61	297	7[2]	304
2011	12	54	164	0	61	279	5[3]	284
2012	13	27	164	0	54	245	5[3]	250
2013	14	12	164	0	50	226	5[3]	231
2014	15	7	164	0	47	218	5[3]	223
2015	16	0	164	0	47	211	5[3]	216
2016	17	0	164	0	46	210	5[3]	215
2017	18	0	164	0	46	210	5[3]	215
2018	19	0	164	0	46	210	5[3]	215
2019	20	0	164	0	46	210	5[3]	215
2020	21	0	164	0	46	210	5[3]	215
2021	–	0	0	0	1	1	0[3]	1
2022	–	0	0	0	1	1	0[3]	1
2023	–	0	0	0	1[4]	1	0[3]	1

[1] Topsoil salvaging, pond and ditch construction.

[2] Topsoil salvage, blasting, and reclamation.

[3] Reclamation.

[4] One staff member would be required for approximately 10 years after final reclamation to manage the property and monitor reclamation until all bonds are released.

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Table 2.17 Predicted Daily Employment Requirements, Transportation Options.

Year	Coal Production Year	Transportation Option(s) 1-2	3	4-6	7-8	9	10
1999	0	0	54[1]	56[2]	20[3]	56[2]	20[3]
2000	1	54-60[4]	7	3-10[5]	12[6]	3-10	12[6]
2001	2	54-60	7	3-10	12	3-10	12
2002	3	54-60	7	3-10	12	3-10	12
2003	4	54-60	7	3-10	12	3-10	12
2004	5	108-114[7]	7	59-64[8]	68[9]	3-10	12
2005	6	61-67[10]	7	27[11]	27[12]	3-10	12
2006	7	7	7	27	27	3-10	12
2007	8	7	7	27	27	3-10	12
2008	9	7	7	27	27	3-10	12
2009	10	7	7	7	7	3-10	12
2010	11	7	7	7	7	3-10	12
2011	12	7	7	7	7	3-10	12
2012	13	7	7	7	7	3-10	12
2013	14	7	7	7	7	3-10	12
2014	15	7	7	7	7	3-10	12
2015	16	7	7	7	7	3-10	12
2016	17	7	7	7	7	3-10	12
2017	18	7	7	7	7	3-10	12
2018	19	7	7	7	7	3-10	12
2019	20	7	7	7	7	3-10	12
2020	21	7	7	7	7	3-10	12
2021	–	20[13]	20[13]	20[13]	20[13]	20[13]	20[13]
2022	–	20	20	20	20	20	20
2023	–	20	20	20	20	20	20

[1] Railroad and coal-handling facility construction.
[2] Haul road construction.
[3] Conveyor construction.
[4] Coal haulage (over-the-road).
[5] Haul road operation and maintenance.
[6] Conveyor operation.
[7] Coal haulage and railroad and coal-handling facility construction.
[8] Haul road operation and maintenance and railroad and coal-handling facility construction.
[9] Conveyor operation and railroad and coal-handling facility construction.
[10] Probably some over-the-road haulage in 2005 as the railroad becomes operational; railroad and coal-handling facility operations and maintenance.
[11] Railroad and coal-handling facility operation and haul road reclamation.
[12] Railroad and coal-handling facility operation and conveyor reclamation.
[13] Corridor, railroad, and coal-handling facility reclamation.

in accordance with Federal Highway Administration (1978) national standards.

All portals, substations, and other hazardous areas would be fenced with a 12-ft high chain-link fence to prevent accidental trespass. Underground mine vehicles would be equipped with fire hoses and water or foam.

2.2.9 Life-of-Mine and Project Time Line

Arch proposes to commence mine development in 1999 and begin mining in 2000. Mine development, including dragline erection and road and facilities construction, would probably occur in the second, third, and fourth quarters of 1999 and would take approximately 9 months to complete. Mining would begin in the third quarter of 2000. The surface mine LOM is based on an estimated sustained production rate of 1.2 to 4.3 million tons/year, although rates will depend on market conditions. Based on an estimated reserve of approximately 31.1 million tons, the surface mining would continue for approximately 11 years (Table 2.12).

Depending on market conditions, initial development of the underground mine would occur in 2003, and underground coal production would begin in 2004 (as continuous miners create portals and panels). The longwall mining system would be fully operational in 2007. Based on an estimated maximum production rate of 6.6 million tons per year, underground mining would continue for 17 years, through 2020. Final reclamation would be completed in 2023. The 10-year bond liability period would end in 2033, providing that the WDEQ-approved reclamation success standards have been met.

2.2.10 Hazardous Materials

Hazardous materials used under the Proposed Action would be similar to the No Action Alternative except that additional materials associated with the longwall mining system, the new loadout facility, and the railroad would be needed.

2.3 MITIGATION AND MONITORING

Existing federal and state rules and regulations require extensive mitigation and monitoring for surface and underground coal mines in Wyoming, which would be applied to this project to mitigate the environmental consequences associated with coal mine development and operation. Under the No Action Alternative, Arch would still be required to permit the mine through WDEQ, which would require mitigation of impacts caused by mining and monitoring. Therefore, for the purposes of this analysis, it is assumed that adherence to WDEQ's Environmental Protection Performance Standards (WDEQ 1996) described in Chapter 5.0, would also be implemented for the No Action Alternative and would be adhered to on state lands; on private land, subject to landowner preferences; and on federal lands used for ROWs to serve the private mine.

Under the Proposed Action, the required mitigation measures for this project are derived from three sources--WDEQ's performance standards (WDEQ 1996), BLM's Coal Requirements and Mitigation (BLM 1990), and BLM's additional measures described in the Planning Review EA (BLM 1997a). Since these documents may not be readily available to many of the reviewers of this EIS, these three sets of requirements are reproduced in Chapter 5.0, Mitigation and Monitoring, and are hereby incorporated into the Proposed Action.

2.4 ALTERNATIVES CONSIDERED BUT NOT ANALYZED IN DETAIL

Eight alternatives were considered but are not analyzed in detail because they were deemed to be unreasonable, impractical, or outside the scope of this EIS. These alternatives, together with the rationale for dismissal, are discussed below.

Hold a competitive lease sale of other tract configurations to make the LBA tract attractive to other bidders. BLM has reconfigured the tract from the original application to make it as attractive as possible. Ark owns over 70% of the land and approximately 60% of the coal in the project area, making it difficult to configure the tract to be more attractive to other bidders.

Hold a competitive lease sale for a BLM-preferred tract configuration. The tract configuration analyzed in this EIS is BLM's preferred tract and is slightly different from the tract originally applied for by Ark. Ark has agreed to apply for the lease of BLM's preferred tract, as stated in a May 13, 1998, letter to the BLM Wyoming State Office, and has modified their application accordingly, so BLM's preferred alternative and the Proposed Action are the same and thus not analyzed as separate alternatives.

Postpone competitive lease sale. Under this alternative, the coal sale would be postponed on the assumption that coal prices would rise in the future, which could increase the fair market value of the tract and result in a higher bonus bid when the coal is sold.

The *Clean Air Act of 1990* includes provisions that encourage the use of low sulfur coal, and while production in Wyoming has increased annually since 1992, prices have not increased at comparable rates. There are three sources of revenue to federal and state governments from the leasing and mining of federal coal: a bonus bid paid at the time the coal is leased, a minimum $3.00/acre rental fee, and a minimum 12.5% royalty for surface-minable coal or a minimum 8% royalty for underground-minable coal which is collected when the coal is sold. The royalty payment is the largest of the three income sources, and since it is collected when the coal is sold, the mechanism is already in place for government revenues to increase if prices rise. Although postponement of the lease sale could conceivably result in a higher bonus payment for the tract, it would not necessarily result in higher royalty payments, although higher coal prices would increase the U.S.'s royalty. It takes several years to lease and permit a coal tract, and coal prices would not necessarily remain high until the coal is actually mined if a sale is postponed. If the coal is already leased when prices increase, the company may be able to negotiate longer term contracts at higher prices.

This alternative was not analyzed further because the potential impacts to economic benefits are unpredictable, and the environmental consequences of mining coal at a later time would probably be similar to those associated with the Proposed Action or alternatives, just delayed for some time. Furthermore, the Seminoe II and Medicine Bow Mines will be closing around the year 2000 and the additional coal is needed to enable Arch to continue operating in the area.

Hold a competitive lease sale for surface-minable coal only (exclude future leasing of underground reserves). This alternative was rejected for the following reasons.

- It would result in a permanent bypass of federal underground-minable coal. Because FLCAA mandates that the Secretary of the Interior evaluate how to achieve maximum recovery of the resource in the tract, to propose only a surface lease in an area where there are minable underground reserves is not likely to be deemed reasonable for compliance with FLCAA.

- It would result in reduced bonus bid and royalty payments to the federal government. Since the economic evaluation is a closed process, the amount of reduction cannot be disclosed in this EIS.

- It would not result in appreciably fewer environmental impacts, because most impacts would be associated with surface mining.

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- It would result in a shorter LOM, thereby exaggerating the adverse effects of boom-and-bust economics in Carbon County.

Hold a competitive lease sale for underground reserves only. Because Ark owns most of the private land and privately held coal within the project area, Arch would be able to develop a surface mine on the private holdings regardless of BLM's requirements for federal land and coal. This alternative would result in the same level of disturbance as the No Action Alternative, with the possible addition of a railroad for coal transportation, but would avoid the bypass of underground-minable federal coal associated with the No Action Alternative. This alternative was rejected because surface disturbance would be reduced only slightly from the Proposed Action and the environmental consequences would be similar.

Alternative Mining Plans (Resource Protection Alternatives). These alternatives were evaluated in response to scoping comments received from the public and other agencies that expressed concern for impacts of mining on various resources, especially wildlife. Alternatives considered included:

- shortening the LOM (i.e., increasing production rates),
- lengthening the LOM (i.e., decreasing production rates),
- altering the mine sequence, and
- shortening the duration of surface mining while extending the duration of underground mining.

A shortened LOM would reduce the duration of impacts on all resources, particularly those identified during scoping, which include the following:

- ground-nesting bird habitat,
- raptor nesting habitat,
- crucial winter range,
- recreational opportunities, and
- visual resources.

The tract, mining methods, and all other aspects of the proposed mine would be the same as for the Proposed Action, except for employment (more employees would be needed to achieve higher production rates but for a shorter period of time), traffic (there would be more traffic for a shorter period of time), and the LOM and project time line. This alternative was rejected because a shortened LOM (i.e., higher production rates) would exaggerate the adverse effects of boom-and-bust economics in the area. Furthermore, Arch's current and expected contracts can be met with production at the levels described for the Proposed Action, not higher levels.

A lengthened LOM (i.e., slower production rates) would prolong the beneficial effects of continued employment and increased revenues to local economies. However, this alternative was not analyzed in detail because it would extend the disturbance period and the consequent loss of wildlife habitat and recreational opportunities, impacts to visual resources, and other environmental consequences associated with mining activities. Furthermore, it would not meet the production levels required by Arch's current and expected contracts.

An alternative mine sequence was evaluated as a potential means to protect wildlife resources. Under this alternative, the mine sequence would be designed, to the extent possible, to disperse disturbance and human activity throughout the project area, thereby minimizing the acreage of disturbance within any given specific location or habitat type, especially crucial winter range, at any one time. Arch would be reclaiming mined-out areas concurrently with on-going mine operations, such that up to 1,856 acres would be disturbed at any given time. Since disturbance at any given time (1,856 acres) would be a small proportion (10%) of the CBCPA, and since the mining plan follows the coal outcrop in a narrow linear pattern, the mining plan as proposed was deemed to meet these objectives. This alternative was incorporated

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into the Proposed Action and thus was not analyzed as a separate alternative.

It was also suggested during scoping that Archveyor™ production be initiated earlier in the mining plan to reduce overall disturbance and expedite pit reclamation. Archveyor™ mining would occur after approximately five passes of the dragline (about 1 year) when a highwall, adequate for Archveyor™ access, has been developed. Initiating Archveyor™ production earlier in the mining plan would also cause the bypass of surface-minable coal and reduce coal royalties, since the Archveyor™ has a 50-60% recovery rate compared to over 90% with surface mining (e.g., dragline). The reduced recovery would not be in conformance with BLM's requirement for maximum economic recovery. For this additional reason, this alternative was not analyzed in detail.

Scoping comments also included a request to examine an alternative for the protection of cultural resources. Provisions for cultural resources protection and mitigation have been included as part of the Proposed Action and the No Action Alternative.

Alternative Mining Methods. Under this alternative, coal would be mined using methods other than the combination dragline/Archveyor™ that is proposed. This alternative was not considered in detail because the open pit/continuous mining methods have proven successful and profitable in the Hanna Basin. This mining method is widely utilized and accepted as economical, environmentally practicable, and allows a maximum recovery of surface-minable coal.

Highway 72 to Four Lanes. Under this alternative, Highway 72 would be upgraded to a four-lane road to reduce the potential for conflicts between haul trucks and public motorists. This alternative is not considered in detail because it is similar to but not as practical as transportation option 4 (see Section 2.2.2) because, while it would result in disturbance adjacent to the existing highway, it would not provide for a physical separation between haul truck and public traffic and thus would not mitigate the possible safety problems. Furthermore, highway reconstruction would cause traffic delays whereas building a separate haul road would not.

2.5 SUMMARY OF ENVIRONMENTAL IMPACTS

The environmental consequences of the Proposed Action, including the transportation options, and the No Action Alternative are summarized in Table 2.18. Detailed discussions of the environmental impacts are provided in Chapter 4.0.

Table 2.18 Environmental Consequences of the Proposed Action and Alternatives.

	Post-mitigation Impacts[1]			
Impact by Environmental Resource	**No Action**	**Proposed Action**	**Difference Between Transportation Options**	**Mitigation(s)[2]**
CLIMATE AND AIR QUALITY				
PM_{10}, NO_x, SO_2, VOC, CO, and CO_2 emissions would increase but remain within state and federal standards	LOM increases in dust and pollutant emissions within and adjacent to the CBCPA	Same as No Action except emissions would be decreased by up to 50% or increased by 10,075%; 11 years longer than No Action	Variation in pollutant emissions associated with coal transportation	Conformance with stipulations of air quality permit including dust suppression during mine development and operations, regular maintenance of roads and equipment, enforcing speed limits, and covering haul trucks
TOPOGRAPHY/PHYSIOGRAPHY				
Short- and long-term disruption of topography	LOM landscape alterations including an overall lowering and flattening of the landscape; disturbance would be 3,270 acres; most disturbance would occur between 1999-2007	LOM landscape alterations of up to 1,626 acres more than No Action, resulting in up to 4,896 acres of total disturbance due to mine development and operation and an additional 7,085 acres affected due to subsidence; 50% more disturbance and 11 years longer than No Action	Disturbance would be up to 709 acres, and timing of disturbance would vary between 1999-2005, depending on the option selected	Interim and final topographic restoration, erosion control, avoiding sensitive features, appropriately engineered facilities
Alteration of surface drainages	LOM local modifications to drainages but no regional impacts; total disturbance of 3,270 acres from 1999-2012	Same as No Action except that up to 50% more disturbance and 11 years longer than No Action	Disturbance would be between 4,322 and 4,896 acres total disturbance, and timing of disturbance would vary between 1999-2005, depending on the option selected	Avoid drainages where feasible; divert and/or contain runoff according to approved mining plan; reestablish and reclaim drainages; replacement of stockponds and playas; use appropriate transportation corridor drainage design; acquire Army Corp of Engineers (ACE) 404 Permits as appropriate
Large-scale lowering of the land surface due to subsidence	Little subsidence would occur due to Archveyor™ mining	8.5-10.0 ft of subsidence over approximately 7,322 acres; slight basin-and-ridge topography created	None	Prompt reclamation of cracks, if any, that form at the surface; controlled subsidence of underground roof rocks
MINERALS/GAS AND OIL				
Localized temporary loss of access to oil and gas reserves	Localized temporary loss of access to oil and gas which could delay oil and gas development	Same as No Action except up to 50% more disturbance and 11 years longer than No Action	Slight variations in ease in access to reserves depending on option selected	Avoid potential future gas and oil development areas, if possible; good faith negotiations with prospective developers; provide crossings along transportation corridors

Table 2.18 (Continued)

Impact by Environmental Resource	Post-mitigation Impacts[1] No Action	 Proposed Action	 Differences Between Transportation Options	 Mitigation(s)[2]
		MINERALS/GAS AND OIL (Continued)		
Localized temporary loss of access to mineral reserves	No present interest in other mineral development in the CBCPA	Same as No Action	Slight variations in access to reserves depending on option selected	Provide crossings along transportation corridors
Bypass of unrecoverable or unleased coal	Bypass of approximately 200.15 million tons of surface- and underground-minable coal; significant	An estimated 112.477 million tons of surface- and underground-minable coal would be unrecoverable and thus bypassed (44% less than No Action); exact amount to be disclosed in tract lease action	None	Use state-of-the-art mining techniques to recover as much coal as possible
Permanent loss of coal resources	Permanent loss of 22.45 million tons of coal; significant	Permanent loss of 119.12 million tons of coal; significant (430% more than No Action)	None	No mitigation recommended
Future seismic exploration precluded in all replaced overburden and subsidence areas	Approximately 3,270 acres would no longer be available for direct seismic tests	Approximately 7,322 acres would no longer be available for direct seismic tests (124% more than No Action)	None	No mitigation recommended
		GEOLOGIC HAZARDS		
Subsidence during and after mining	Little or no subsidence anticipated	8.5-10.0 ft of surface lowering over approximately 7,322 acres	None	Adherence to WDEQ-approved subsidence mitigation and monitoring plan; prompt reclamation of any cracks that form at the surface; controlled subsidence of underground roof rocks
Earthquake damage to facilities	Facilities unlikely to be damaged due to earthquakes because earthquakes are unlikely	Same as No Action	None	Construct facilities to withstand moderate earthquakes
Flood damage to facilities	Facilities unlikely to be damaged due to flooding because floods are unlikely	Same as No Action	None	Avoid floodplains and flood-prone areas, where feasible; construct during periods of low or no flow; construct facilities to withstand floods
Landslides and slumping	Possible landslides due to spoil placement on slide-prone areas	Same as No Action	None	Avoid unstable areas where feasible; initiate controlled slope movements to stabilize landslides; implement appropriate and timely reclamation and erosion control

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Table 2.18 (Continued)

Impact by Environmental Resource	Post-mitigation Impacts[1] No Action	Proposed Action	Difference Between Transportation Options	Mitigation(s)[2]
		GEOLOGIC HAZARDS (Continued)		
Reactivation of dunes due to ground cover removal	Dunes not likely to be reactivated	Same as No Action	None	Avoid windblown deposits where feasible; use soil stabilizers; implement appropriate and timely reclamation
Subsidence, gas, and fires associated with abandoned coal mines	Abandoned coal mines not expected to affect any facilities	Same as No Action	None	Avoid abandoned mine areas; mine through abandoned mines using proven technology from the Seminoe II Mine
		PALEONTOLOGICAL RESOURCES		
Disturbance/destruction of important fossils	Little potential to destroy important fossils because preconstruction surveys have been/would be completed within the CBCPA	Same as No Action except potential loss of 19 sites and up to 50% more disturbance than No Action	Disturbance due to mine development and operations would range from 4,222-4,896 acres, depending on the option selected	Avoid, recover, and/or monitor as determined during preconstruction BLM paleontological surveys; educate employees
Loss of important fossil materials due to private collection or vandalism	Little potential for unauthorized fossil collection	Same as No Action except there would be up to 50% more disturbance	Disturbance due to mine development and operations would range from 4,222-4,896 acres, depending on the option selected	Avoid, recover, and/or monitor as determined during preconstruction BLM paleontological surveys; educate employees
Discovery of previously unknown fossils	Good potential to discover previously unknown (significant and nonsignificant) fossils during preconstruction surveys	Same as No Action except the preconstruction survey area would be up to 50% larger	Disturbance due to mine development and operations would range from 4,222-4,896 acres, depending on the option selected	All ground-disturbing activities within 250 ft of the discovery would cease until the discovery is evaluated by a BLM-approved paleontologist
		SOILS		
Mixing of physical and chemical properties	Post-reclamation soils would be more uniform in color, texture, structure, depth, organic matter content, and chemical composition	Same as No Action but area of effect would be up to 1,686 acres (50%) more	Disturbance due to mine development and operations would range from 4,222-4,896 acres, depending on the option selected	No mitigation recommended
Disruption of soil biology	Disruption of biologic activity; soil organic matter loss; and mortality of microbial populations, seeds, bulbs, and live plant parts	Same as No Action but area of effect would be up to 1,686 acres (50%) more and effect would be longer in duration	Disturbance due to mine development and operations would range from 4,222-4,896 acres, depending on the option selected	Direct haulback of salvaged soils, where feasible; minimizing stockpiling times; prompt revegetation of replaced soils; possible addition of soil amendments

Table 2.18 (Continued)

Impact by Environmental Resource	Post-mitigation Impacts[1] No Action	Proposed Action	Difference Between Transportation Options	Mitigation(s)[2]
SOILS (Continued)				
Soil loss via wind and water erosion	Up to 3,270 acres of disturbance	Up to 4,896 acres of disturbance; 50% more than No Action	Potential to encounter erosion-prone soils along transportation corridor; disturbance due to mine development and operations would range from 4,322-4,896 acres, depending on the option selected	Avoid erosion-prone areas where feasible; implement appropriate and timely use of erosion and sedimentation control techniques/devices; adhere to WDEQ-approved mine and reclamation plans
Sensitive soils difficult to reclaim	Anticipate sufficient mixing of sensitive soils with good soils such that no effects are anticipated	Same as No Action	Disturbance due to mine development and operations would range from 4,322-4,896 acres, depending on the option selected	No mitigation recommended
Soil compaction and decreased productivity	LGM decreased productivity in all disturbed areas	Same as No Action except overall disturbance would be 50% greater	Disturbance due to mine development and operations would range from 4,322-4,896 acres, depending on the option selected	Adhere to WDEQ-approved mine and reclamation plans; restrict off-road vehicle travel
Contamination due to accidental hazardous material spills	LGM potential for localized spills within the CBCPA	Same as No Action	Slight variations in potential for spills and the consequences of spills depending on the option selected	Adhere to hazardous materials management and spill prevention, control, and countermeasures plans; adhere to speed limits and other safety measures to prevent accidents along the transportation routes
SURFACE WATER RESOURCES				
Potential for decreased water quality (i.e., increased turbidity, salinity, and sedimentation) in surface waters due to runoff from disturbed areas	Surface water quality impacts not anticipated	Same as No Action	Slight variations in potential for surface water quality impacts during construction of the various options, but no impacts anticipated	Use appropriate diversions and erosion and sedimentation control techniques/devices; adhere to WDEQ-approved mine and reclamation plans; avoid surface water bodies, where feasible; minimize disturbance
Minor surface water loss	Approximately 25 acre-ft per year of surface water loss due to evaporation from sediment ponds	Same as No Action	None	No mitigation recommended
Alteration of surface water runoff patterns due to planned diversions	Surface drainage patterns would be altered for the LGM, but regional patterns would not be affected	Same as No Action	None	Use appropriately engineered and maintained diversions; interim and final drainage restoration according to WDEQ-approved mine and reclamation plans

Table 2.18 (Continued)

Impact by Environmental Resource	Post-mitigation Impacts[1]			Mitigation(s)[2]
	No Action	Proposed Action	Difference Between Transportation Options	
SURFACE WATER RESOURCES (Continued)				
Contamination of surface waters from accidental hazardous material spills	Surface water contamination from accidental spills unlikely	Same as No Action	Slight variation in potential for spills and consequences of spills depending on the option selected	Adhere to WDEQ-approved mine and reclamation plans and hazardous materials management and spill prevention, control, and countermeasure plans
Indirect effects due to topographic changes	Increased infiltration, reduced runoff, reduced peak flows	Similar to, but greatly increased from, No Action because subsidence would occur	Slight variations depending on the option selected	No mitigation recommended
GROUNDWATER RESOURCES				
Groundwater contamination due to accidental hazardous material spills	Groundwater contamination from accidental spills unlikely	Same as No Action	None	Adhere to WDEQ-approved mine and reclamation plans and hazardous materials management and spill prevention, control, and countermeasure plans
Direct groundwater consumption	Consumption of up to 26,000 gallons/day	Consumption of up to 126,000 gallons/day; 385% more than No Action and duration of impact would be 11 years greater	Slight variations in the amount of groundwater consumed depending on the option selected (e.g. groundwater required for dust suppression on haul roads)	Use recycling systems for continuous miners and longwall mining system, adhere to WDEQ-approved mine and groundwater monitoring plans
Indirect groundwater consumption	Groundwater loss via evaporation during coal seam dewatering	Same as No Action but duration of impact would be 11 years longer	None	No mitigation recommended
Aquifer removal and disruption	Removal/disruption of aquifers underlying approximately 3,270 acres within the CBCPA; change in aquifer permeability	Same as No Action but area of impact would be up to 7,322 acres; 124% greater than No Action	None	Adhere to WDEQ-approved monitoring plan
Drawdown effects on groundwater users	No effects anticipated	Same as No Action	None	Replace water in amount and in quality to any permitted user that is potentially affected
Long-term reduction in groundwater quality	Postmine aquifers likely to have higher concentrations of calcium, sulfate, magnesium, manganese, and TDS than premining aquifers	Same as No Action	None	Adhere to WDEQ-approved groundwater monitoring plan; bury unsuitable overburden away from groundwater
ALLUVIAL VALLEY FLOORS				
Possible disruption of alluvial valley floors	No impacts anticipated	Same as No Action	None	No mitigation recommended

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Table 2.18 (Continued)

Impact by Environmental Resource	Post-mitigation Impacts[1]			
	No Action	Proposed Action	Differences Between Transportation Options	Mitigation(s)[2]
		NOISE		
Increased noise levels at the mine site and along transportation corridors	LGM noise levels increased, especially during surface mining, 24 hours per day	Same as No Action but 11 years longer in duration	Variations in noise levels at particular locations depending on the option selected	Use equipment mufflers; regular maintenance of all equipment, schedule blasting during daylight hours; use hearing protection as required by MSHA
Increased noise levels at nearby residences and at the Conoco Station	No noise or blasting noise is likely to be heard; truck noise would be heard at the Conoco Station and by Elmo residents	Same as No Action	Variations in noise levels at particular locations depending on the option selected	Use equipment mufflers; regular equipment maintenance
		ODOR		
Presence of offensive odors proximal to facilities and roads	LGM odors due to equipment exhaust and dust	Same as No Action but 11 years longer in duration	Slight variations in odors at particular locations depending on the option selected	Regular equipment maintenance
		ELECTRIC AND MAGNETIC FIELDS		
Adverse human health effects	Adverse human health effects unlikely	Same as No Action	None	No mitigation recommended
Television (TV) or radio interference	Interference unlikely	Same as No Action	None	No mitigation recommended
		VEGETATION		
Vegetation removal	Up to 3,270 acres of vegetation removed	Up to 4,896 acres of vegetation removed; 50% more than No Action	4,322-4,896 acres of vegetation disturbed and variations in the timing of disturbance depending on the option	Adhere to WDEQ-approved mine and reclamation plans; minimize disturbance; implement appropriate and timely reclamation, erosion control, and revegetation
Changes in vegetation diversity following reclamation (i.e., shrubland to grassland)	Short-term reduction in diversity and number of shrubs, but diversity and shrub reestablishment required by WDEQ, so no permanent impacts; up to 3,270 acres affected	Same as No Action except up to 4,896 acres affected; 50% more than No Action	4,322-4,896 acres of vegetation disturbed and variations in the timing of reclamation	Adhere to WDEQ-approved reclamation plan; control weeds; restrict off-road vehicle travel; revegetate with native/approved species
Temporary loss of vegetative productivity	Short- and long-term loss of vegetative productivity due to vegetation removal and slow establishment on reclaimed areas	Same as No Action except area of effect would be up to 4,896 acres (50%) more	4,322-4,896 acres of vegetation disturbed and variations in the timing of disturbance depending on the option	Initial, interim, and final reclamation in accordance with WDEQ-approved reclamation plan

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Table 2.18 (Continued)

	Postmitigation Impacts[1]			
Impact by Environmental Resource	**No Action**	**Proposed Action**	**Difference Between Transportation Options**	**Mitigation[2]**
		VEGETATION (Continued)		
Potential weed infestations	Possible weed infestations on areas disturbed by mine development and operation	Same as No Action except area of effect would be up to 4,886 acres; 30% more than for No Action	4,322-4,886 acres of vegetation disturbed and variations in the timing of disturbance depending on the option	Control weeds in accordance with WDEQ-approved weed control plan
Wetland and riparian area loss	Short-term to LOM wetland and riparian area loss; approximately 15.8 acres lost	Same as for No Action except approximately 20.5 acres lost, 30% more than for No Action	Variations in the acreage of wetlands potentially affected	Adhere to WDEQ-approved wetland mitigation plan; avoid wetlands and riparian areas, where feasible; obtain ACE 404 Permits as necessary
		WILDLIFE		
Loss of big game crucial habitat	Loss of up to 3,270 acres of pronghorn and up to 1,042 acres of mule deer crucial range; locally significant	Loss of up to 4,107 acres of pronghorn (26% more than No Action) and up to 1,700 acres of mule deer (63% more than No Action) crucial range; locally significant	Additional crucial habitat loss (up to 255 acres) and variations in the timing of such losses depending on the option selected	Adhere to WDEQ-approved reclamation and wildlife monitoring plans; minimize project activities in crucial winter range; implement appropriate reclamation with shrub species
Big game displacement and/or stress	LOM displacement from actively mined and adjacent areas and transportation corridors	Same as No Action except overall disturbance would be up to 30% higher and 11 years longer in duration	Variations in displacement area depending on the location of and activity associated with the transportation corridor	Avoid construction and minimize other activities within crucial habitat during crucial periods
Overall wildlife habitat (i.e., small mammals, amphibians, and reptiles) degradation	Up to 3,270 acres of habitat degradation for the LOM and beyond	Up to 4,886 acres of habitat degradation for the LOM and beyond; 30% more than No Action	Variations in the amount of habitat degraded and timing, depending on option selected	Adhere to WDEQ-approved reclamation and wildlife monitoring plans; appropriate monitoring, containment, and disposal of hazardous material
Increased wildlife mortality from human activities	LOM potential for mortality due to traffic and other hazards	Same as No Action but 11 years longer in duration	Variable, depending on the option selected; conveyor haulage would probably minimize mortality	Use appropriate road design; adhere to posted speed limits; educate employees; appropriately contain and dispose of hazardous material
Avian mortality due to collisions with haul trucks or power lines	LOM potential for avian mortality; direct mortality would constitute an illegal take and thus would be significant	Same as No Action but 11 years longer in duration	Variable depending on the option selected	Continued consultation with USFWS to ensure compliance with the Endangered Species Act, Bald Eagle Protection Act, and Migratory Bird Treaty Act

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Table 2.18 (Continued)

	Postmitigation Impacts			
Impact by Environmental Resource	**No Action**	**Proposed Action**	**Difference Between Transportation Options**	**Mitigation(s)**
		WILDLIFE (Continued)		
Loss of sage grouse breeding, nesting, and wintering habitat	Loss of 123 and 2,759 acres of breeding and nesting/ wintering habitat, respectively; significant	Loss of up to 139 and 3,602 acres of breeding and nesting/wintering habitat, respectively (13% and 31% more than for No Action); significant	Additional loss of breeding habitat and of nesting/wintering habitat; variable depending on the option selected	Adhere to WDEQ-approved reclamation and wildlife monitoring plans; minimize project activities in these areas; implement appropriate reclamation with shrub species
Loss of mountain plover foraging, breeding, and nesting habitat	Loss of 187 acres of mountain plover foraging, breeding, and nesting habitat	Same as No Action except 238 acres would be disturbed due to mining (a 28% increase over No Action)	Variable depending on the location of the haul route relative to plover habitat	Adhere to WDEQ-approved reclamation and wildlife monitoring plans; avoid mountain plover habitat; conduct predisturbance mountain plover surveys
Depletion of surface waters resulting in fish population reductions	An estimated 35 ac-ft/yr surface water would be lost due to evaporation from sediment ponds, 2000-2007	Same as No Action except duration would be 2000-2020	None	Adhere to WDEQ-approved reclamation and wildlife monitoring plans; avoid riparian areas and implement proper erosion control techniques; pay depletion fee to USFWS
Raptor nest taking	Up to 13 nests taken	Up to 14 nests taken	No additional nests taken	Adhere to WDEQ-approved reclamation and wildlife monitoring plans; consult with USFWS and BLM and obtain required permits prior to nest removal; coordinate mitigation measures (e.g., erection of artificial nest structures) with USFWS and BLM
Raptor nest disturbance due to human activity within 0.75 mi of nest	Up to 47 nests potentially affected	Up to 49 nests potentially affected; 4% more than No Action	Up to 42 nests potentially affected, depending on the option selected	Adhere to WDEQ-approved reclamation and wildlife monitoring plans; minimize activity within 0.75 mi of active nests during the nesting season, where feasible

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Table 2.18 (Continued)

Impact by Environmental Resource	Post-mitigation Impacts[1]			
	No Action	Proposed Action	Difference Between Transportation Options	Mitigation(s)[2]
THREATENED AND ENDANGERED SPECIES/STATE SENSITIVE SPECIES				
Mortality or disturbance of any listed or candidate T&E species or disturbance of critical habitat for listed and candidate T&E species	Low potential for bald eagle, peregrine falcon, swift fox, and black-footed ferret mortality; moderate potential for mountain plover mortality; LCM and beyond loss and degradation of habitat for these species	Same as No Action except that overall habitat loss/degradation would be greater	Variable depending on location of haul routes relative to T&E species habitat	Adhere to WDEQ-approved reclamation and wildlife monitoring plans; design and place facilities to avoid areas known or suspected to be used by these species; minimize habitat disturbance; avoid prairie dog colonies where feasible; conduct preconstruction black-footed ferret surveys
Reduction in sensitive species due to mortality or habitat loss/degradation	LCM potential for sensitive species mortality and habitat loss/degradation	Same as No Action except that habitat loss/degradation would be greater	Variable depending on location of haul routes relative to sensitive species habitat	Adhere to WDEQ-approved reclamation and wildlife monitoring plans; avoid habitats of potential concern, where feasible; consult with USFWS and BLM and obtain required permits prior to ferruginous hawk nest removal; coordinate mitigation measures (e.g., erection of artificial nest structures) with USFWS and BLM
Destruction of TECRS plant species or their habitat	Loss of TECRS plant species and their habitat is unlikely	Same as No Action	Variable depending on location of haul routes relative to TECRS species habitat	Predisturbance surveys for TECRS plant species; avoidance of individuals or habitat, where feasible
CULTURAL RESOURCES				
Disturbance/destruction of important sites	10 cultural resource sites would be lost during mine development and operation but appropriate data would be collected prior to mine development	Loss of 20 cultural resource sites (100% more than No Action)	Variable depending on the option selected	Complete cultural surveys and data recovery as required by Section 106 of the NHPA
Loss of important cultural materials due to private collection or vandalism	Loss due to unauthorized collection or vandalism is unlikely	Same as No Action	None	Maintain compliance with Section 106 of the NHPA; ensure employee education; disciplinary action as appropriate
Disturbance of important Native American religious or culturally significant sites	Disturbance of important Native American sites unlikely	Same as No Action	None	Consult with Native American groups to mitigate impacts; complete Section 106 process prior to issuing ROD

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Table 2.18 (Continued)

	Postmitigation Impact¹			
Impact by Environmental Resource	**No Action**	**Proposed Action**	**Difference Between Transportation Options**	**Mitigation(s)¹**
		SOCIOECONOMICS		
Increased employment	Slight LCM-increased employment and loss of employment after 2007	LCM-increased employment for 20 years	Slight variations in employment depending on the option selected	No mitigation recommended
Increased population	Population increase unlikely	Same as No Action	None	Employ as many local personnel as possible
Increased demand for temporary housing	Additional demand for temporary housing unlikely	Same as No Action	None	Employ as many local personnel as possible
Increased demand for school services	Increased demand for school services would not increase appreciably	Same as No Action	None	Employ as many local personnel as possible
Increase in tax revenue and royalties and stimulation of local economy	LCM-increased federal, state, and local revenues	Same as No Action but 11 years longer in duration	None	No mitigation recommended
Increased demand for local government facilities or services	Additional demand for local government facilities and services would not increase appreciably but would be extended approximately 13 years	Slight increased demand for local government facilities and services would be extended approximately 20 years	None	Employ as many local personnel as possible
Disruption or change of character of communities	Disruption/change of community character unlikely; community life would be extended approximately 13 years	Same as No Action except community life would be extended approximately 20 years	None	Employ as many local personnel as possible
Increased traffic and demands on local highways and other roads; increased accidents	LCM-increased traffic by mine employees commuting to from work and from construction equipment and over-the-road haul trucks	Same as No Action except that over-the-road haul truck traffic would continue through 2018 instead of 2007	No haul truck traffic on highways for options 2-10	Use professional truck drivers; use headlights and sidelights; avoiding over-the-road hauling when school buses are on the roads; use of proper signing; monitor and repair roads as needed
		LAND USE		
Reduction of AUMs for livestock and wildlife	LCM loss of up to 165 AUMs	LCM loss of up to 181 AUMs; 9% more than No Action	Slight variations in loss of AUMs depending on route selected	Implement appropriate and timely reclamation; revegetate with palatable and productive species

Table 2.18 (Continued)

Impact by Environmental Resource	Postmitigation Impact No Action	Proposed Action	Differences Between Transportation Options	Mitigation
LAND USE (Continued)				
Loss of forage due to fires started by mine and transportation equipment	Any fires would be suppressed immediately so forage loss would be minimal	Same as No Action	Railroad options may have greater fire hazard than haul truck or conveyor options	Maintain equipment in proper working condition at all times, prohibit outdoor smoking during high fire hazard periods, restrict vehicular traffic to approved roads
Localized temporary loss of access to mineral reserves	No present interest in other mineral development in the CBCPA	Same as No Action	Slight variations in access depending on location of haulage route relative to reserves	Provide crossings along transportation corridors
Localized temporary loss of access to oil and gas reserves	Oil and gas development would be hindered but not necessarily curtailed by mine development and operation	Same as No Action but disturbance due to mine development and operations and subsidence would be increased by up to [illegible] acres ([illegible]) and would be 11 years longer in duration; access to reserves outside CBCPA would be hindered by the transportation corridors	Slight variations in access depending on location of haulage route relative to reserves	Avoid potential future gas and oil development areas, if possible; good faith negotiations with prospective developers; provide crossings along transportation corridors
Changes in character and recreational uses of the area due to construction, presence of facilities, noise, dust, odor, and increased human activities	LOM loss of recreational opportunities in and adjacent to CBCPA	Same as No Action except 11 years longer in duration	Variable depending on location of haul route relative to recreational use areas	Maintain roads as appropriate; use equipment mufflers; minimize disturbance areas; implement appropriate and timely reclamation
Infringement on prior rights	Prior rights would be observed for the LOM	Same as No Action	None	Avoid existing ROWs where feasible; use appropriate construction procedures at ROW crossings; develop cooperative agreements were possible conflicts occur
VISUAL RESOURCES				
Modification in the basic elements (form, line, color, or texture) of visual resources by presence of facilities and equipment	LOM and beyond modification of visual characteristics for viewers in the mine vicinity but generally not visible from I-80 or Highway 72	Same as No Action except there would be additional visual impacts from the transportation corridors	Variable depending on the option selected	Paint facilities with standard environmental colors and, where feasible, locate to blend with surrounding landscape; minimize cuts and fills and other visible landscape alterations; implement appropriate and timely reclamation and revegetation

Table 2.18 (Continued)

	Postmitigation Impact¹			
Impact by Environmental Resource	**No Action**	**Proposed Action**	**Differences Between Transportation Options**	**Mitigations²**
		HAZARDOUS MATERIALS		
Soil, surface water, and groundwater contamination and wildlife exposure	Contamination and exposure unlikely for the LOM and beyond	Same as No Action	Variable depending on the option selected; haul trucks might have a greater risk of accidental spills than a railroad or conveyor	Adhere to hazardous materials management and spill prevention, control, and countermeasures plans; implement appropriate monitoring, containment, and disposal of hazardous material

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[1] All impacts are not significant unless otherwise stated.

[2] Mitigations apply to both alternatives and the transportation corridors; details are provided in Chapter 5.0.

3.0 AFFECTED ENVIRONMENT

Critical elements of the human environment (BLM 1988), their status in the project area, and their potential to be affected by the proposed project are listed in Table 3.1. Three critical elements (areas of critical environmental concern, prime or unique farmlands, and wild and scenic rivers) are not present and are not discussed in this EIS. Wilderness is not present in the CBCPA but is discussed in terms of possible cumulative air quality affects on nearby wilderness areas. In addition to critical elements, this EIS discusses potential effects of the proposed project on climate, topography/physiography, geology, minerals, geologic hazards, paleontological resources, water quantity and use, soils and watershed, noise, odor, electric and magnetic fields, vegetation, wildlife and fisheries, socioeconomics, surface ownership and use, and visual resources.

3.1 PHYSICAL RESOURCES

3.1.1 Climate

Climate in the CBCPA is classified as continental, semiarid, cold desert (Trewartha and Horn 1980). Annual temperatures at Elk Mountain, 3.0 mi southeast of the CBCPA, average 42°F. Average daily temperature at Elk Mountain ranges from 22°F in January to 64°F in July, with an extreme high of 95°F and an extreme low of -42°F (Martner 1986).

Table 3.1 Critical Elements of the Human Environment in the CBCPA.

Element[1]	Status on CBCPA	Addressed in Text of EIS
Air quality	Affected	Yes
Areas of critical environmental concern	None present	No
Cultural resources	Potentially affected	Yes
Environmental justice	Not affected	Yes
Farmlands (prime or unique)	None present	No
Floodplains	Potentially affected	Yes
Native American religious concerns	Potentially affected	Yes
Threatened and endangered species	Potentially affected	Yes
Wastes, hazardous or solid	Potentially affected	Yes
Water quality	Affected	Yes
Wetlands/riparian zones	Affected	Yes
Wild and scenic rivers	None present	No
Wilderness	None present	Yes[2]

[1] As listed in BLM *NEPA Handbook H-1790-1* (BLM 1988).

[2] Addressed in cumulative impacts analysis.

The CBCPA is within the 10- to 14-inch precipitation zone (BLM 1987a:135). Annual precipitation averages 12 inches (Martner 1986), 44% of which occurs during March through June. Precipitation is lowest from December through February. Summer precipitation is generally produced by convective thunderstorms that seldom exceed 1 inch in total rainfall. The CBCPA receives an average of 40 thunderstorms each year. Mean annual pan evaporation is relatively high at 70 inches.

Average annual snowfall is approximately 82 inches at Elk Mountain and 45 inches at Medicine Bow. Snow accumulation patterns and redistribution are determined by the effects of topography and vegetation on windblown snow and have a marked effect on vegetation, wildlife, hydrology, and human activities.

The CBCPA is located in a region of Wyoming known as the wind corridor, where cold wind from the west and southwest is channeled eastward across the Continental Divide (Martner 1981; Marwitz and Martner 1981; Martner and Marwitz 1982). Annual wind speeds average from 4.5 to 21.5 miles per hour (mph) and are greatest during the afternoon and in winter (Martner 1986). The wind corridor has some of the strongest and most persistent winds in the U.S.

3.1.2 Air Quality

Air quality in the region is generally good (BLM 1995a). The CBCPA is located entirely within the Laramie Air Basin, which is designated as a Prevention of Significant Deterioration (PSD) Class II area under the WDEQ, Air Quality Division (AQD) Implementation Plan (BLM 1987a:152-168). PSD Class II areas are those that may be developed, and the release of limited concentrations of certain pollutants over Class II PSD increments is permitted as long as National Ambient Air Quality Standards are maintained (AQD 1989) and emissions are within the PSD Class II increment. The nearest PSD Class I area (an area where little air quality deterioration is allowed) is the Savage Run Wilderness, located approximately 30 mi south-southwest of the CBCPA. Although the State of Wyoming manages the Savage Run Wilderness as a Class I wilderness, it is not a federally mandated PSD Class I area (i.e., it has not been designated Class I by Congress and thus legally does not have to be managed as a Class I area) (BLM 1995a), and the state is not proposing to apply for a federal Class I designation (personal communication, June 1998, with Darla Potter, WDEQ). Other Class I areas in the region include the Bridger Wilderness in Wyoming and the Mount Zirkel Wilderness in Colorado.

Air quality monitoring stations would be established prior to mine development in accordance with Chapter I, Section 22(j) of the Wyoming Air Quality Standards and Regulations (WDEQ 1989) and air quality would be monitored for the LOM. Parameters to be monitored would likely include PM_{10}, TSP, wind speed and direction, temperature, and precipitation. The number and distribution of monitor stations would be determined by WDEQ during air permitting and would depend on site-specific factors such as production levels. Ambient air quality data for the CBCPA are not yet available, but there are historical data for air quality at Hanna and qualitative data from the GDRA Draft RMP/EIS (BLM 1987a:154-169).

Ambient air quality was measured by AQD at Hanna from 1980 to 1983. Annual total suspended particulate (TSP) concentrations were 22.8-66.7 micrograms per cubic meter ($\mu g/m^3$) (personal communication, December 1994, with Bob Schick, AQD). The standard for mean annual TSP in this area is 60 $\mu g/m^3$. The maximum 24-hour concentrations ranged from 87 to 228 $\mu g/m^3$ (the maximum 24-hour standard is 150 $\mu g/m^3$). In Hanna in 1980, there were seven measurements above the standard.

The principal air quality pollutants in Wyoming are particulates (BLM 1987a:157). Fugitive dust (uncontrolled wind-carried particles) from natural sources, surface coal mines, highway construction, roads, and other types of development or disturbances (e.g., recreation and livestock grazing) increases the ambient level of suspended particulates in and adjacent to the CBCPA, especially during dry windy periods (BLM 1987a). Visibility in the region is very good (generally greater than 70 mi), and fine particles are considered to be the main source of visibility degradation (BLM 1998b).

Climatic factors such as prevailing winds, atmospheric stability, and mixing heights affect air quality by influencing the ability of air to disperse or dilute pollutants. Unstable conditions, caused by vertical movement of air heated near the ground during the day combined with moderate to high wind speeds, provide conditions conducive to dispersing and diluting pollutants and maintaining air quality (BLM 1987a:157). These conditions occur more than 70% of the time throughout most of the GDRA.

3.1.3 Topography/Physiography

The proposed coal mines and transportation corridors would be located primarily in the Carbon Basin, a deep structural and topographic basin composed of 11,000-14,000 ft of sedimentary rocks. The Carbon Basin is separated from the Hanna Basin by a northeast-trending anticline that forms Simpson Ridge. Elevation within the CBCPA ranges from 6,820 ft in the floodplain of Second Sand Creek to 7,660 ft on Simpson Ridge. Relief between plains and ridges is typically less than 200 ft. The landscape is composed of rolling hills, relatively flat floodplains and uplands, deeply dissected valleys, and steep ridges. In the CBCPA, drainage is predominantly to the east-northeast via Third and Second Sand Creeks, which are tributaries to the Medicine Bow River. In the Simpson Ridge vicinity, drainage is to the northeast into First Sand Creek. The transportation corridor areas also ultimately drain into the Medicine Bow River via ephemeral channels, although a small portion of runoff drains into playas with no outlets. The project area is within the Medicine Bow River watershed which is within the North Platte River watersheds.

3.1.4 Geology

The Hanna Formation is the predominant surficial rock unit within the CBCPA (Figure 3.1); other surficial units include the Lewis Shale, the Mesaverde Group, the Medicine Bow Formation, and Quaternary alluvial deposits (Love and Christiansen 1985). Alluvium is confined to valleys and major drainages. The Hanna Formation is composed of fluvial deposits of light yellowish gray siltstone and sandstone, greenish gray siltstone, brown mudstone, gray shale, carbonaceous shale, and coal (Figure 3.2) (Morrison-Knudsen Company, Inc. 1983). Coal beds, in ascending order, include the Johnson Seam; Blue Group; Lower Finch Group; Upper Finch Group; and Beds 106, 107, 108, 109, 110, and 111. Figure 3.2 shows a typical stratigraphic section of the Hanna Formation in the Carbon Basin. In portions of the CBCPA, the Johnson Seam, shown at depth on the column, actually outcrops at the surface and dips to depths of up to 500 ft to the north.

Throughout the project area, the Hanna Formation unconformably overlies the Medicine Bow Formation or the Lewis Shale (Morrison-Knudsen Company, Inc. 1977; BLM 1979; Vaughn Hansen Associates, Inc. 1982). The Medicine Bow Formation is a light gray to white, fluvial, quartzose sandstone (Morrison-Knudsen Company, Inc. 1983). The Lewis Shale is a gray marine shale containing many gray and brown lenticular sandstone beds. Both the Medicine Bow Formation and Lewis Shale outcrop on the margins of the Carbon Basin. The alternate transportation corridors also intersect the Steele Shale, the Ferris Formation, and the Mesaverde Group.

Overburden would be composed primarily of rock from the Hanna Formation (Morrison-Knudsen Company, Inc. 1977). Overburden quality is generally good. In some strata, pH, sodium adsorption ratio (SAR), and electrical conductivity (EC) levels are high enough to be considered

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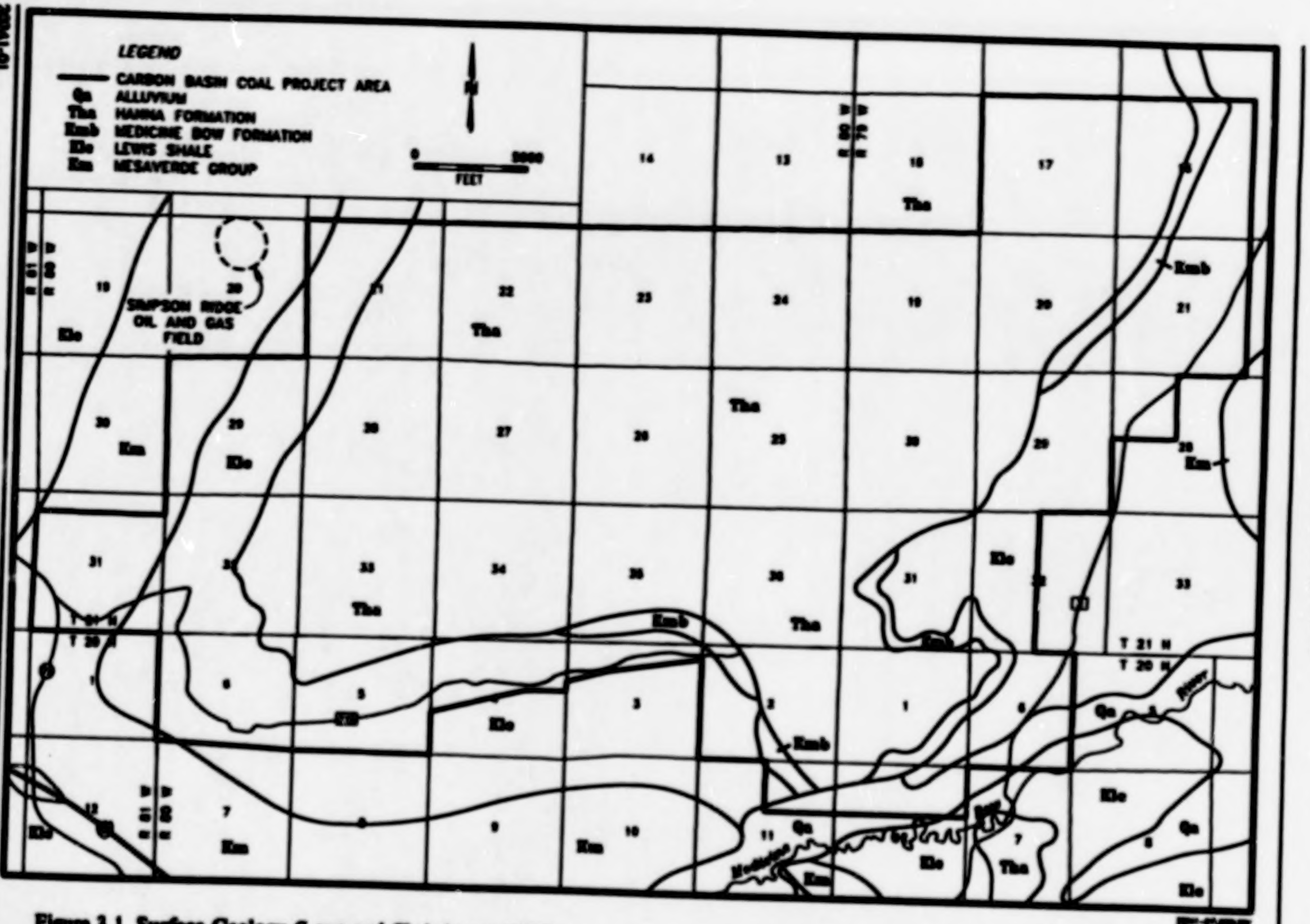
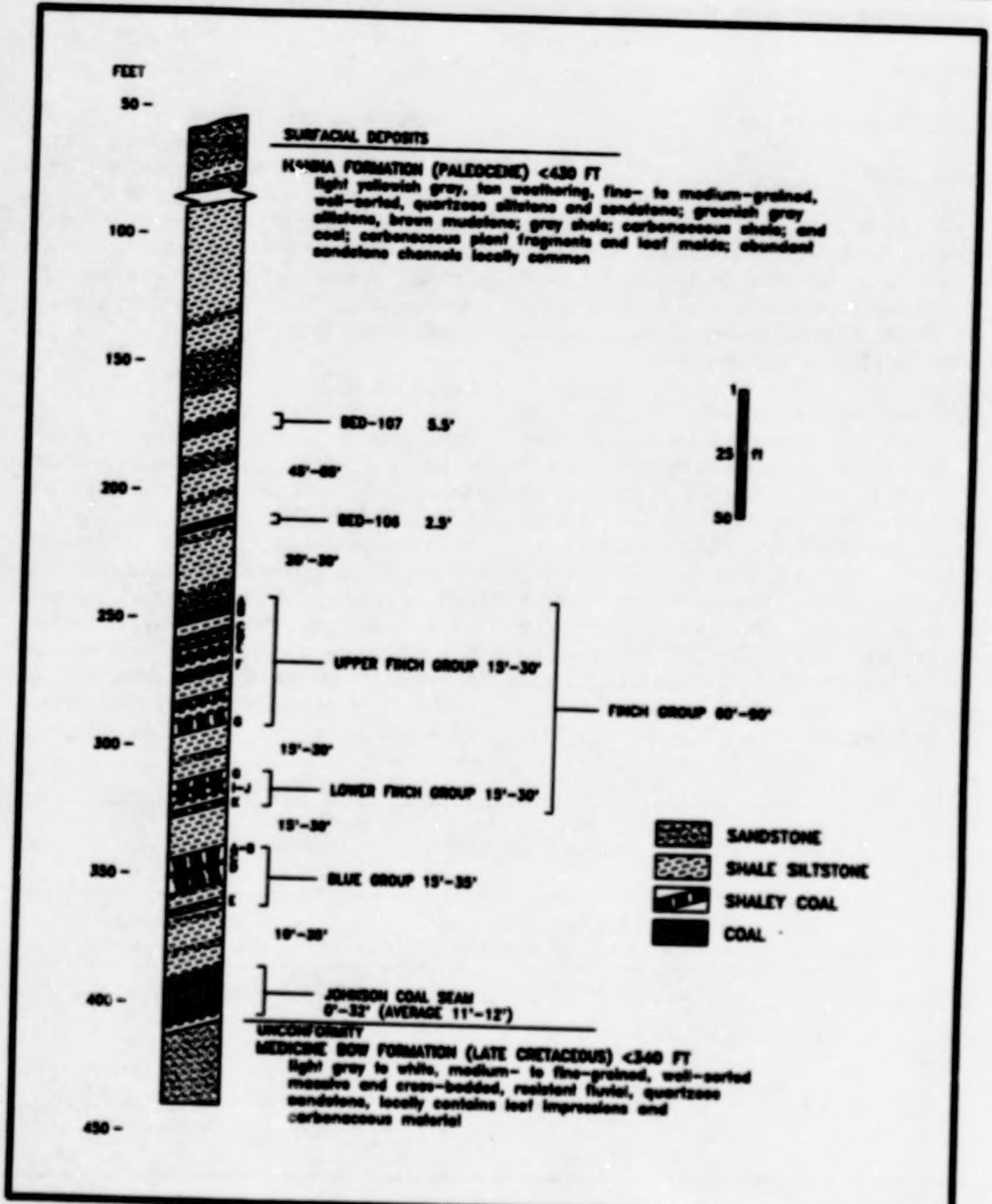


Figure 3.1 Surface Geology (Love and Christiansen 1985).


FEET
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SURFACIAL DEPOSITS
HANNA FORMATION (PALEOCENE) <430 FT
light yellowish grey, tan weathering, fine- to medium-grained, well-sorted, quartzose siltstone and sandstone; greenish grey siltstone, brown mudstone; grey shale; carbonaceous shale; and coal; carbonaceous plant fragments and leaf molds; abundant sandstone channels locally common
BED-107 5.5'
45'-60'
BED-106 2.5'
20'-30'
UPPER FINCH GROUP 15'-30'
FINCH GROUP 60'-90'
15'-30'
LOWER FINCH GROUP 15'-30'
15'-30'
BLUE GROUP 15'-35'
10'-20'
JOHNSON COAL SEAM
0'-32' (AVERAGE 11'-12')
UNCONFORMITY
MEDICINE BOW FORMATION (LATE CRETACEOUS) <340 FT
light gray to white, medium- to fine-grained, well-sorted massive and cross-bedded, resistant fluvial, quartzose sandstone, locally contains leaf impressions and carbonaceous material
1
25 ft
50
SANDSTONE
SHALE SILTSTONE
SHALEY COAL
COAL

Figure 3.2 Stratigraphy of the Hanna Formation (Morrison-Knudsen Company, Inc. 1983).

harmful to the environment (Table 3.2), but these strata do not represent a large proportion of the overburden.

3.1.5 Mineral Resources

3.1.5.1 Coal

Coal reserves in the CBCPA are predominantly contained in the Hanna Formation (Table 3.3). There are an estimated 34.5 million tons of low-sulphur bituminous surface-minable coal and 197.1 million tons of underground-minable coal within the CBCPA (see Table 1.1).

Compared with other coal beds, the Johnson Seam (the principal seam proposed for mining), which occurs at the base of the Hanna Formation, is most consistent in quality, distribution, and thickness and thus is the most important seam within the Hanna Formation (Morrison-Knudsen Company, Inc. 1977). In areas proposed for surface-mining, depth of the Johnson Seam ranges from 0 to 200 ft below the ground surface. In areas proposed for underground mining, the Johnson Seam is 200-600 ft underground. Thickness ranges from very thin or absent up to 32 ft and averages approximately 11-12 ft. The Johnson Seam contains few partings, but shaley zones (1.0-2.0 inches thick) are common throughout the seam.

The Blue Group occurs approximately 10-35 ft above the Johnson Seam. It consists of a series of thin coal beds in a zone approximately 15-35 ft thick, some of which may be economically minable. The Finch Group occurs 15-30 ft above the Blue Group in a 45- to 90-ft zone. It also contains several good-quality economically valuable seams. Other seams are not known to contain minable coal.

3.1.5.2 Oil and Gas

There are currently no producing oil or gas wells within the CBCPA or along the transportation corridors (DeBruin and Boyd 1991; WOGCC 1996; BLM 1997a:26). The Simpson Ridge field is located adjacent to the project area (Figure 3.1) but is plugged (personal communication, June 1998, with Nancy Barclay, WOGCC), and there are no oil and gas pipelines related to this field that would have to be relocated or otherwise protected to prevent damage during mining. Sinclair Oil Corporation holds five oil and gas leases within the area, but no exploration or

Table 3.2 Potentially Harmful Overburden Characteristics.

Strata Location	Environmentally Harmful Constituent	Estimated Proportion of Overburden
Unknown	pH = 4.8, acid-generating potential	Not specified
20-25 ft above Johnson Seam	SAR = 13	<8%
0-30 ft below ground surface	EC = 3.6 to 5.4	Not specified

Source: Morrison-Knudsen Company, Inc. 1977. (Overburden was reportedly sampled according to WDEQ guidelines although the project was abandoned before WDEQ approval.)

Table 3.3 Coal Characteristics.[1]

Coal Seam	Average Thickness (ft)	BTU/lb	Sulphur (%)	Ash (%)	Moisture (%)
Bed 107	n/a	n/a	n/a	n/a	n/a
Bed 106	n/a	n/a	n/a	n/a	n/a
Finch Group	8.04	11,450	0.50	8.74	9.88
Blue Group	n/a	n/a	n/a	n/a	n/a
Johnson Seam	13.66	11,280	0.60	11.27	11.00
Carbon No. 5	8.36	10,540	0.33	11.27	10.02

Source: Glass and Roberts 1979.

[1] n/a = data not available from this source.

development is occurring, and potential for near-future oil and gas development in the CBCPA or along the transportation corridors is slight.

3.1.5.3 Coalbed Methane

Potential methane-bearing coal beds include the Hanna and Medicine Bow Formations and the Mesaverde Group (Glass and Jones 1991). Currently, there are no coalbed methane leases within the CBCPA or along the transportation corridors, and because there are economic uncertainties of recovering this resource, development in the project area in the near future is unlikely. There has been some interest in developing coalbed methane in the Hanna Basin (BLM 1993), but it was never proven economically feasible; comparable projects have not been proposed for the Carbon Basin.

3.1.5.4 Locatable Minerals

There are no known economically recoverable deposits of locatable minerals (e.g., precious metals, bentonite) within the CBCPA or along the transportation corridors (BLM 1987a:126; Harris et al. 1985; Hausel et al. 1994), and there are no leases or claims in the area (BLM 1997a:27).

3.1.5.5 Salable Minerals

There are numerous construction aggregate quarries in the CBCPA vicinity, but none occur within the project area or along the transportation corridors. Salable minerals within the project area include sand, stone, gravel, clay, and scoria. Sand and gravel have been excavated from deposits near Simpson Ridge and along the Medicine Bow River, and other recoverable deposits of salable minerals probably occur in isolated deposits throughout the CBCPA (Harris and Meyer 1986).

3.1.6 Geologic Hazards

The potential for seismic activity in the CBCPA is low (personal communication, May 1994, with James Case, Wyoming Geological Survey [WGS]), and there are no known or suspected active faults in the area (Case 1990; Case et al. 1990). An earthquake with an epicenter in the northern portion of the Simpson Ridge area occurred on August 17, 1973 (Case 1986). Three earthquakes with intensities of III and IV on the modified Mercali scale occurred near Medicine Bow between 1938 and 1955. Intensity is a qualitative estimate of the perceived amount of ground shaking--intensity III and IV earthquakes are

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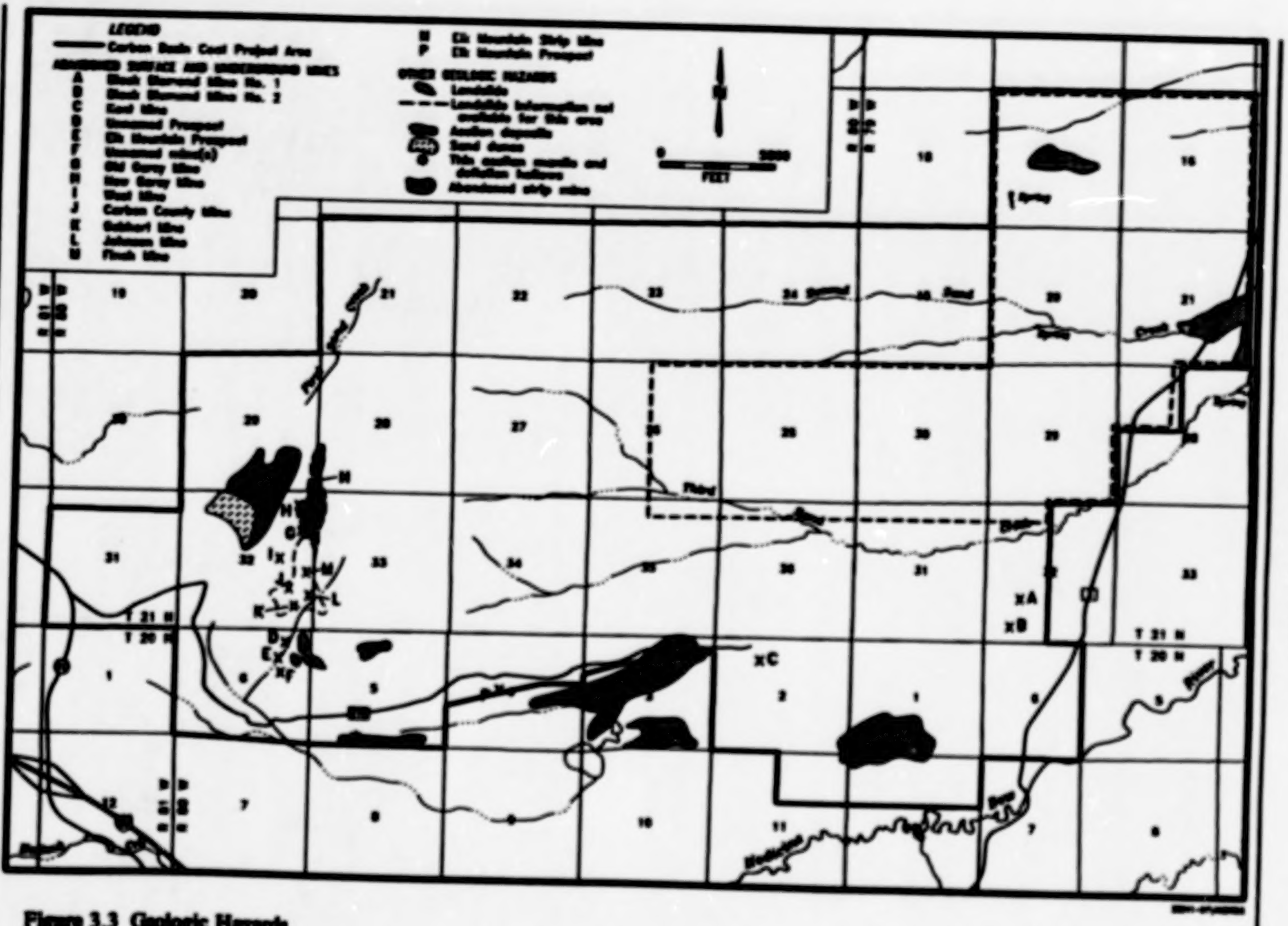

Figure 3.3 Geologic Hazards.

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noticeably felt indoors, but only barely, if at all, noticeable outdoors. The Seminoe Reservoir area in the northern part of the Hanna Basin experienced five earthquakes with magnitudes of 2.9-3.1 (Richter scale) between 1989 and 1993 (Case 1990, 1994). The Richter scale is a quantitative measure of the magnitude (i.e., the relative amplitude of ground motion caused by seismic waves) of an earthquake; magnitudes of 2.9-3.1 are relatively small.

There are numerous areas within the CBCPA and adjacent to the transportation corridors that were previously mined, including underground mines which may have subsided or have the potential for subsidence (Figure 3.3). In the vicinity of sec. 6, T.20 N., R.80 W., and sec. 32, T.21 N., R.80 W., there are six underground mines (e.g., the New and Old Carey Mines, West Mine, Johnson Mine, Carbon County Mine, and Gebhart Mine). The two Black Diamond Mines and the Kent Mine also occur in the project area, along with numerous surface prospects, underground mining shafts, and abandoned surface mines.

Subsidence has occurred in several abandoned underground mines in the vicinity of Hanna and Carbon (Case 1986; personal communication, February 1998, with Jim Nyenhuis, Soil Scientist). However, the underground mines within the CBCPA are small compared with the Hanna and Carbon Mines, and potential for large-scale subsidence is low at small mines (where minor subsidence is most frequently observed at or adjacent to the mine mouth). Therefore, there is a very low potential for additional subsidence of existing abandoned mines within the CBCPA.

Landslide areas occupy approximately 37 acres (<1%) within the CBCPA (Figure 3.3). Aeolian deposits (windblown sand) and sand dunes occur in isolated patches and occupy approximately 713 acres (3.9%) and 49 acres (<1%) within the CBCPA, respectively (Figure 3.3). Larger deposits occur adjacent to the Soda Lakes (3 mi northwest of the CBCPA) and along Second Sand Creek in sec. 21, T.21 N., R.80 W., in the CBCPA and continuing northeast outside of the CBCPA.

Several Special Flood Management Areas occur within the CBCPA (Figure 3.4) (Federal Emergency Management Agency [FEMA] 1987). Areas along the major rivers and creeks within the area (e.g., the Medicine Bow River, Second and Third Sand Creeks) are designated Zone A, which are known as areas of 100-year flood risk, although base flood elevations and flood hazard factors have not been determined. Most upland areas between the major creeks are classified Zone C, which are areas with minimal flooding potential. Portions of the project area are Zone D, which are areas of undetermined flood hazard.

3.1.7 Paleontology

A paleontologic resource inventory and evaluation of lands within the CBCPA was conducted in July and August 1997. Because BLM amended the LBA tract in May 1998 to include sections of federal coal on the northern edge of the project area, sec. 21-24, T.21 N., R.80 W., and sec. 19, T.21 N., R.79 W., were not surveyed but would be surveyed if Arch permits these sections with WDEQ. Review of literature and records documented one known fossil locality within the CBCPA; it occurs in the Hanna Formation and contains fossil leaves. Two other localities occur adjacent to the area. One occurs in the Hanna Formation and consists of fragmentary vertebrate fossils, and the other occurs in the Lewis Shale and contains invertebrate fossils characteristic of the *Baculites clinolobatus* zone (Hyden and McAndrews 1967). Significant vertebrate fossils have been discovered in the Medicine Bow and Hanna Formations north and northeast of the project area (personal communication, 1997, with Jason Lillegraven and Ross Secord, Department of Geology and Geophysics, University of Wyoming [UW]). The alternate transportation corridors have not yet been field inventoried, but a literature and records review was completed to determine the paleontologic potential of formations underlying the potential corridors and to assess the need for field surveys.

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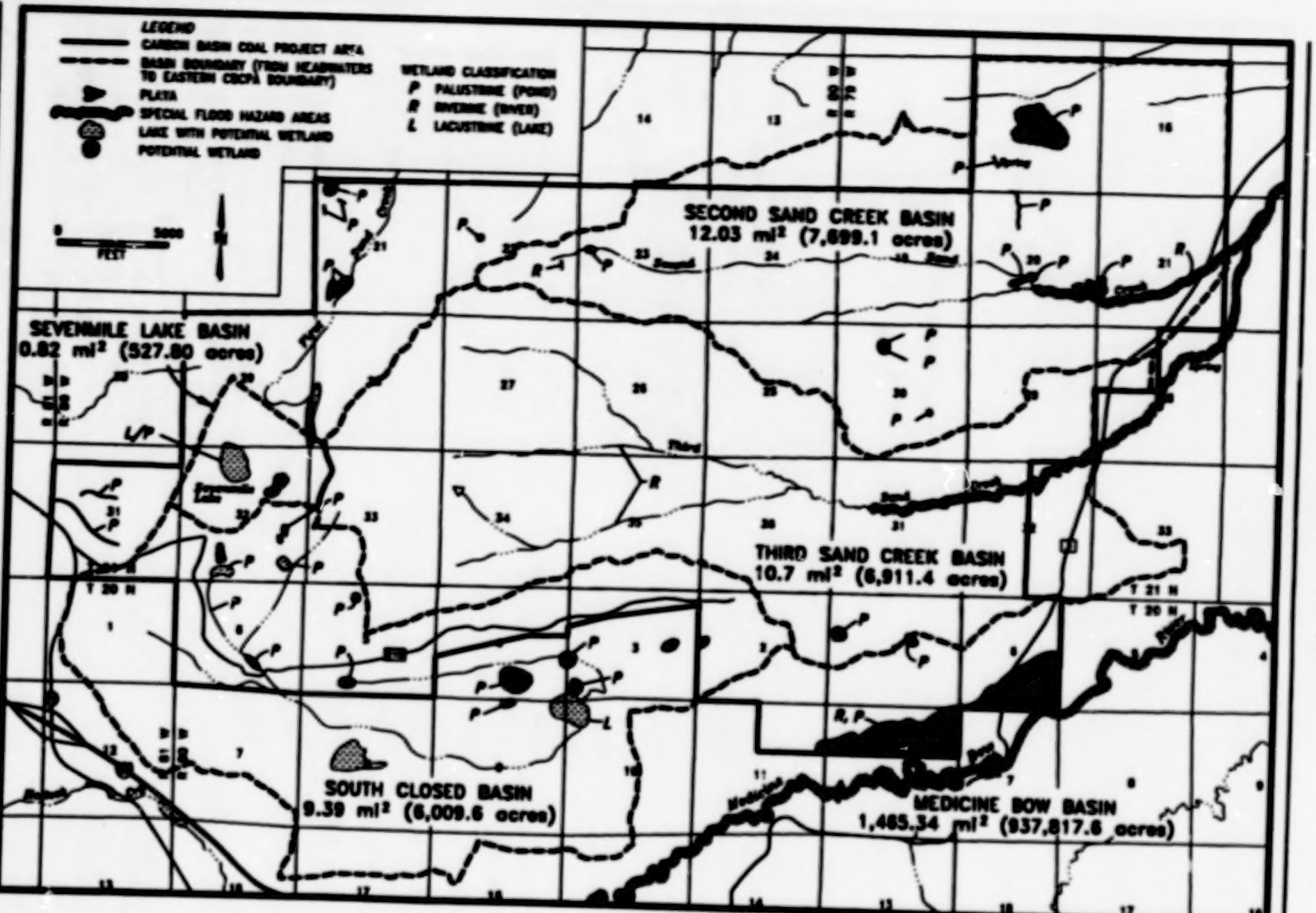

Figure 3.4 Surface Waters, Wetlands, and Special Flood Management Areas.

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The CBCPA (except the five sections along the northern boundary) was field-surveyed for paleontological resources in 1997 and showed that the potential to discover significant paleontological resources throughout most of the CBCPA is low (Table 3.4). The Mesaverde Group has produced diverse vertebrate fossils from widely dispersed localities in central Wyoming, although to date, few have been discovered in the Mesaverde Group in Carbon County. Fossils from the group in adjacent areas include the remains of plants, marine invertebrates, and marine and terrestrial vertebrates. Nonmammalian vertebrates from the formation include sharks, rays, bony fish, amphibians, turtles, lizards, crocodiles, ornithischian and saurishican dinosaurs, a champsosour, a pterosaur, a snake, and a bird (Breithaupt 1985; Case 1987). Dinosaurs from the formation include the genera *Edmontosaurus* and *Albertosaurus*. The formation has also produced fossils from 12 mammal species (Clemens and Lillegraven 1986; Lillegraven and McKenna 1986) in Natrona County and a few in Carbon County (personal communication, 1997 and 1998, with Jason Lillegraven, Department of Geology and Geophysics, UW). Mammals from the formation include species of multituberculates and primitive marsupial and placental mammals. The formation has also produced abundant remains of invertebrates including ammonites, baculites, bivalves, and planktonic foraminifera (Keefer 1972; Kauffman 1977; Shapurji 1978). A small portion of the unsurveyed area overlies the Mesaverde Group.

The Lewis Shale is known to contain a variety of marine invertebrate fossils, including many genera of bivalves, baculites, and ammonites. Isurid shark teeth have also been recovered from the formation at localities in Carbon County (Breithaupt 1985). The Fox Hills Sandstone locally forms the top of the Lewis Shale throughout south-central Wyoming and is often lumped with the Lewis Shale because it is too thin to be depicted accurately on conventional-scale maps. A small portion of the unsurveyed area is underlain by the Lewis Shale. The Fox Hills Sandstone is known to contain shallow-water marine invertebrate fossils, including a large variety of clams and snails, three distinctive types of ammonites, a species of bryozoan, and trace fossils (e.g., ophiomorpha). The remains of oysters were discovered during field surveys of the Lewis Shale and Fox Hills Sandstone within the CBCPA at several localities scattered throughout the formation and were most abundant in the northeastern part of the area in sec. 16 and 21, T.21 N., R.79. W. Oyster remains are known to occur in beds scattered throughout these formations and are not considered to have scientific significance.

The Medicine Bow Formation is known to contain the remains of terrestrial plants, marine and freshwater invertebrates, and terrestrial vertebrates. Plant remains from the Medicine Bow Formation include pollen, leaf and stem imprints, and petrified and carbonized wood. Invertebrate fossils include the remains of marine foraminifera and brackish water gastropods and bivalves representing at least 21 species (Gill et al. 1970). Dinosaur bone fragments from the ceratopsian *Triceratops* have been found in the lower part of the formation (Bowen 1918; Lull 1933; Breithaupt 1985, 1994), and the formation has also produced the remains of a small number of mammals of Lancian (latest Cretaceous) age (Lillegraven 1995). Bone localities in the Medicine Bow Formation are rare (personal communication, June 1997, with Jason Lillegraven, UW).

Fossil plants and invertebrates were observed in the Medicine Bow Formation at several localities within the CBCPA. Plant remains were found at widespread locations in association with coal. No localities yielded well-preserved fossil plant leaves. Fossil gastropods were identified at one locality which contains a 2-ft thick layer of tightly packed gastropod shells that range in length from a fraction of an inch to several inches in length. These fossils are of scientific interest, but because these types of fossils are fairly common in this formation, they are not scientifically significant.

The Hanna Formation is known to contain the remains of terrestrial vertebrates, invertebrates,

Table 3.4 Paleontological Potential of Geologic Formations Within the CBCPA.

Geologic Deposit	Geologic Age	Type of Deposit/ Environment of Deposition	Fossil Resources	Paleontologic Potential Based on Literature and Records	Paleontologic Potential Based on Field Survey	Location
Mesaverde Group	Late Cretaceous	Sandstone, siltstone, mudstone, shale, and coal; marine to terrestrial, near shore, shoreline, deltaic, fluvial, estuarine, swamp	Vertebrates, invertebrates, plants, trace fossils	High	Low	Forms ridges of Simpson Ridge and low ridges southeast of Allen and East Allen Lakes
Lewis Shale (including Fox Hills Sandstone)	Late Cretaceous	Sands, silts, and shales; marine-shoreline, near shore, offshore	Vertebrates, invertebrates, trace fossils	Moderate	Low	Forms low-lying outcrops and valleys in south (T.20 N., R.80 W.) and east (T.21 N., R.79 W.)
Medicine Bow Formation	Latest Cretaceous	Sands, silts, coals, and shales; marine-estuarine, brackish, deltaic, terrestrial-fluvial	Vertebrates, invertebrates, plants	High	Low	Forms cliff faces and cuestas along southern (T.20 N., R.80 W.) and eastern (T.21 N., R.79 W.) part of area
Hanna Formation	Paleocene-Eocene	Sands, silts, coals, shales, and conglomerates; terrestrial-fluvial, lacustrine, swamp	Vertebrates, invertebrates, plants	High	Low	Widespread in T.21 N., R.79 W.-R.80 W.
Alluvium and Colluvium	Holocene (Recent)	Unconsolidated silts, sands, and conglomerates of valleys and hill tops; terrestrial-fluvial, eolian	None	Low	Low	Widespread overlying older deposits

and plants (Gill et al. 1970; Ryan 1977; Lillegraven 1995; Secord 1996; personal communication, 1997, with Ross Secord, Department of Geology and Geophysics, UW). Prior to the 1970s, the only vertebrate fossils reported from the Hanna Formation were fish scales, turtle fragments, and the fragmentary jaw of a condylarth (*Claenodon*). During the late 1970s, a nearly complete lower jaw of a phenacodont condylarth (*Tetraclaenodon*) was discovered. Fossil vertebrates from the Hanna Formation are now known to include a wide variety of mammals, reptiles, and fish of Paleocene age. Near the northern edge of the CBCPA, Secord (1977) noted the occurrence of fragmentary fossil vertebrate remains in sandstones of the Hanna Formation. Most of the unsurveyed area within the CBCPA overlies the Hanna Formation.

During the 1997 field survey of the CBCPA, a single locality containing fragmentary vertebrate fossils was discovered in the Hanna Formation, although the locality is unlikely to yield any significant fossils. Fossil plant remains were discovered at widely dispersed localities associated with coals and carbonaceous shales in the Hanna Formation. Plant imprints (leaves and wood) were abundant in strata directly overlying coals. Several fossil tree trunks occurred in carbonaceous and coaly shale.

The transportation corridors have not been field-surveyed, but paleontologic potential was assessed via literature and database searches. Geologic formations occurring along the corridors, in addition to those within the CBCPA, include the Ferris Formation and the Steele Shale. The Ferris Formation is known to include the remains of terrestrial vertebrates, invertebrates, and plants (Gill et al. 1970; Ryan 1977; Hansen 1986; Lillegraven 1995) (Table 3.5). Fossils from the formation record the end of the Mesozoic Era and the beginning of the Cenozoic Era and thus provide crucial scientific information about dinosaur extinction. Plant fossils include microfossil (pollen) and megafossil (leaf and stem imprints, petrified and carbonized wood) remains of late Cretaceous to Paleocene age. Invertebrates include the remains of freshwater gastropods, bivalves, and ostracods. Dinosaur bone fragments have also been discovered (Bowen 1918; Lull 1933; Breithaupt 1985, 1994). Until recently, the only fossil vertebrate remains from the formation have included the ceratopsian *Triceratops* and an undescribed genus of turtle. In recent years, additional fossils have been discovered in both the lower and upper parts of the Ferris Formation including diverse remains of a wide variety of dinosaurs and crocodilians of late Cretaceous age and Paleocene mammals (Eberle 1994, 1995a, 1995b, 1996; Eberle and Wroblewski 1996a, 1996b; Lillegraven 1995; Wroblewski 1995; personal communication, 1997 and 1998, with Jason Lillegraven, Department of Geology and Geophysics, UW).

Fossils are abundant in limestone concretions and thin sandy beds of the Steele Shale and include marine invertebrates (i.e., 15 genera of bivalves, scaphites, and ammonites). Shark teeth have been discovered in Natrona and Carbon Counties (personal communication, 1997 and 1998, with Jason Lillegraven, Department of Geology and Geophysics, UW). The remains of marine fish, crocodiles, mosasaurs, plesiosaurs, and turtles have been identified in equivalent strata (i.e., Cody Shale, Pierre Shale, Niobrara Formation) at widely dispersed localities in eastern and northern Wyoming (Weishampel 1992) and could occur in the Steele Shale.

3.1.8 Soils

Many different soils occur within the project area due to varying parent material, topography, local hydrology (e.g., snow accumulation areas), vegetation, and wind patterns. Soils within CBCPA occur in four major landscape positions (Natural Resources Conservation Service [NRCS] 1970; VTN, Colorado, Inc. 1978; Edison Development Company-Centennial Coal 1983; personal communication, February 1998, with Jim Nyenhuis, Soil Scientist):

- generally south-facing ridge crests, ledges, and steep slopes associated with sandstone and shale bedrock ridges (ridge-rockland areas);
- generally north-facing backslopes of sandstone and shale ridges;
- alluvial fans and toe slopes; and
- terraces and bottomlands of major drainages including Second and Third Sand Creeks.

Soils of the ridge-rockland areas are located on ridge crests, ledges, and steep slopes, occur on thin residuum and colluvium, and are considered sensitive. Soils associated with the ridge-rockland areas include Shinbara, Blazon, Moyerson, and Renstac soils; however, rock outcrops dominate the area (15%) and other soils are represented by small patches and inclusions. Bedrock areas dominated by steep shale slopes and sandstone cliffs are nearly barren of soil. All of these soils are very shallow to shallow and vary in soil texture and rock fragment content. They are generally calcareous, mildly to moderately alkaline, and nonsaline. With disturbance, wind and water erosion hazard is high. Selenium and boron contents are very low and well within suitable levels for use as topsoil (as prescribed by WDEQ). On the west side of the CBCPA, previous mining activities have disturbed ridges and are in various stages of soil development and vegetation establishment. In general, little soil is available for salvage from the ridge-rockland areas (Table 3.6).

On the north-facing backslopes, Blazon, Worfka Variant, and Satanka soils occur on uplands with sagebrush vegetation on gentle slopes (3-20%) and are shallow to moderately deep, but are not, in general, considered sensitive. These soils are generally calcareous, mildly to moderately

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Table 3.5 Paleontologic Potential of Geologic Formations Along the Alternate Transportation Corridors.

Geologic Deposit	Geologic Age	Type of Deposit/Environment of Deposition	Fossil Resources	Paleontologic Potential Based on Literature and Records	Type of Field Survey Recommended	Location
Alluvium and Colluvium	Holocene (Recent)	Unconsolidated silts, sands, and conglomerates of valleys and hill tops; terrestrial-fluvial, aeolian	None	Low	None	Widespread overlying older deposits
Hanna Formation	Paleocene-Eocene	Sands, silts, coals, shales, and conglomerates; terrestrial fluvial, lacustrine, swamp	Vertebrates, invertebrates, plants	High	Detailed pedestrian	Widespread in Hanna Basin and Carbon Basin
Ferris Formation	Latest Cretaceous-Paleocene	Conglomerate, sandstone, and shale of latest Cretaceous; sandstone, limestone, and coal beds of Paleocene; terrestrial, alluvial fan, alluvial plain, pond, swamp, and fluvial	Vertebrates, invertebrates, plants, trace fossils	High	Detailed pedestrian	Northeast-trending band northwest of Simpson Ridge and northern end of Carbon Basin
Medicine Bow Formation	Latest Cretaceous	Sands, silts, coals, and shales; marine-estuarine, brackish, deltaic, terrestrial-fluvial	Vertebrates, invertebrates, plants	High	Detailed pedestrian	Northeast-trending band northwest of Simpson Ridge and extensively in the northern end of the Carbon Basin
Lewis Shale (including Fox Hills Sandstone)	Late Cretaceous	Sands, silts, and shales; marine shoreline, near shore, off shore	Vertebrates, invertebrates, trace fossils	Moderate	Reconnaissance	Forms low-lying outcrops and valleys around Simpson Ridge and in the eastern and southeastern portions of the Carbon Basin
Mesaverde Group	Late Cretaceous	Sandstone, siltstone, mudstone, shale, and coal; marine to terrestrial, near shore, shoreline, deltaic, fluvial, estuarine, swamp	Vertebrates, invertebrates, plants, trace fossils	High	Detailed pedestrian	Forms ridges of Simpson Ridge and low ridges southeast of Allen and East Allen Lakes
Steele Shale	Late Cretaceous	Dark grey shale, thin sandstone and limestone; marine, offshore, muddy shelf, near shore to offshore	Marine vertebrates, invertebrates, trace fossils	Moderate	Reconnaissance	Forms low-lying areas surround Allen and East Allen Lakes

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Table 3.6 Topsoil Salvage Depths and Volume of Suitable Soil Available for Reclamation Within the CBCPA.

Landscape Position	Acres of Salvageable Soil Within the General Area of Effect (No Action Alternative and Proposed Action)[1]	Average Salvage Depth (inches)	Estimated Salvage Volume (cu yd)
Ridge-rockland areas	387	6.0	312,180
North-facing backslopes	901	18.0	2,180,420
Alluvial fans and toeslopes	532	48.0	3,433,173
Terraces and bottomlands[2]	205	18.0	595,320
Total	2,025	11.76[3]	6,521,093

[1] Since the leasing decision has not yet been made, the area of effect is not yet known, so these acreages apply to both the No Action and the Proposed Action Alternatives. Exact acreages and salvage volumes would be determined for the mine permit applications.

[2] These soils are not likely to be disturbed by mining and only minimally disturbed due to construction of the various transportation alternatives.

[3] Weighted average topsoil salvage depth.

alkaline, and nonsaline and have high wind and moderate to high water erosion hazards. Soil textures include loam, sandy loam, sandy clay loam, clay loam, and clay with less than 35% rock fragments. Selenium and boron contents are very low and well within suitable levels for use as topsoil. On average, approximately 18 inches of suitable topsoil and subsoil material is available for salvage from these backslope areas (see Table 3.6).

Alluvial fans and toeslope soils are often located between backslopes and drainages and include Forelle, Patent, Yamac, Ryan Park, Rock River, and Fluetsch soils. In general, these types are not considered sensitive. Soils are typically fine loams, sandy clay loams, and coarse loams. These soils are deep (40-60 inches to bedrock) or very deep (>60 inches) and have similar textures and chemistry to backslope soils. If disturbed, these soils have high wind and moderate water erosion hazards. On average, 48.0 inches of topsoil and subsoil are salvageable; however, in certain areas, deeper salvage depths may be possible (Table 3.6).

Terrace and bottomland soils are deep to very deep with textures ranging from gravelly sandy loam to clay and are considered sensitive. Havre is the dominant soil type and occurs in unconsolidated floodplain and terrace deposits of sand, silt, and clay with lenses of gravel. The upper 18 inches of Havre is generally nonsaline and nonalkaline, but the substratum can be either nonsaline or highly saline and nonalkaline or highly alkaline. As such, only the upper 18.0 inches of this soil would be salvaged, if necessary (see Table 3.6), although other soil types in these areas may be salvaged to 48.0 inches.

A total of 6,521,093 cu yd of topsoil is available for salvage within the general area of effect (Table 3.6). Topsoil replacement depth over the entire disturbance area would average 12 inches. Topsoil availability along the transportation corridors would be similar. Sensitive soils (ridge-rockland and terrace and bottomland soils) occur along each of the alternate transportation corridors (Table 3.7).

Soils within the CBCPA are classified as suitable for use during reclamation in accordance with WDEQ standards. Selenium and boron levels in soils within the CBCPA are below WDEQ suitability thresholds of 0.1 and 5 ppm, respectively. One sample--a sample of the Havre soil at 35-70 inches below the surface which had 0.16-0.24 ppm selenium--exceeded the selenium standard (personal communication, February 1998, with Jim Nyenhuis, Soil Scientist).

3.1.9 Water Resources

3.1.9.1 Surface Water

Surface Water Quantity. The CBCPA lies within the Medicine Bow River watershed which is within the North Platte River watershed. The normal annual precipitation (12 inches) produces approximately 0.13 cubic feet per second (cfs) of runoff per square mile of drainage area. Runoff occurs mainly as a result of summer thunderstorms and rain showers; however, a small portion results from snowmelt (Mesilla Valley Engineers, Inc. 1977). Runoff events are of high intensity and short duration.

The principal drainages within the CBCPA are Second and Third Sand Creeks, which are tributaries of the Medicine Bow River, the only perennial stream in the vicinity (Figure 3.4). The extreme northwest corner of the project area is drained by First Sand Creek. Second Sand Creek flows east through the CBCPA and intersects the Medicine Bow River approximately 3 mi east of the CBCPA. Third Sand Creek flows southeast and then turns northeast, leaves the CBCPA, and flows 2.5 mi to its confluence with Second Sand Creek. Watershed areas for Second and Third Sand Creeks are 12.0 square (sq) mi and 10.7 sq mi, respectively. The southwestern portion of the CBCPA lies in a closed basin approximately 9.4 sq mi in size.

On average, Third Sand Creek flows 10 to 15 days per year, not necessarily consecutively. Peak flows range from 77 to 1,580 cfs (Wyoming Water Resources Center [WWRC] 1997), and mean annual discharge at the U.S. Geological Survey (USGS) gauging station near County Road 3 is 725 acre-ft. Third Sand Creek contributes approximately 0.6% of the mean annual discharge of the Medicine Bow River (129,000 acre-ft) (Mesilla Valley Engineers, Inc. 1977). Flow data for Second Sand Creek are not available.

The perennial Medicine Bow River flows adjacent to the CBCPA's southeastern boundary. It derives most of its flow from snowmelt and, to a lesser extent, from groundwater inflow and occasional thunderstorms. For the 54-year period between 1940 and 1993, mean daily flow in the Medicine Bow River above Seminoe Reservoir, approximately 10 mi north of Hanna, was typically less than 20 cfs but ranged from 12 to 3,059 cfs. Flows were highest in May and June and lowest in September and January (USGS 1994).

Chapman Draw, First Sand Creek, Carbon Creek, Jim Creek, Percy Creek, and Standpipe Draw are located along the routes of one or more transportation corridors. There are 24 ponds, lakes, playas, impoundments, and springs within CBCPA, most of which occupy less than 1 acre (Figure 3.4). They are generally located in low areas in or adjacent to streams and are ephemeral, seasonal, or semipermanent in nature. Sevenmile Lake occupies approximately 80 acres. There are also numerous surface waterbodies adjacent to, but not crossed by, the transportation corridors.

Surface Water Quality. Surface water quality within the CBCPA and vicinity is highly variable but is generally classified as poor and suitable only for wildlife and livestock use (Vaughn Hansen Associates, Inc. 1982). During periods of rapid snowmelt, surface water quality is better than during periods of intense thunderstorms because snowmelt runoff tends to cause less erosion than storms. During periods of snowmelt, water in Third Sand Creek may be acceptable for human consumption (BLM 1979). None of the streams

Table 3.7 Acreage of Sensitive Soils Along the Transportation Corridors.

Transportation Corridor	Ridge-Rockland Soils (acres)	Terrace and Bottomland Soils (acres)	Total (acres)
Railroad R-1 (options 1-8)	0.8	16.3	17.1
Railroad R-2 (options 1-8)	8.9	35.5	44.4
Haul Road B-1 (option 4)	15.3	22.8	38.1
Haul Road B-2 (option 5)	16.2	86.0	102.2
Haul Road B-3 (option 6)	64.5	61.8	126.3
Conveyor C-1 (option 7)	3.9	7.6	11.5
Conveyor C-2 (option 8)	7.0	17.0	24.0
Haul Road D-1 (option 9)	0.0	24.8	24.8
Conveyor D-2 (option 10)	4.4	3.1	7.5

within the CBCPA or along the transportation corridors are classified as impaired by WDEQ (personal communication, June 1998, with Chuck Harnish, WDEQ).

The watersheds of Second and Third Sand Creeks are identified in the GDRA RMP as an "area needing special management due to the high potential for accelerated erosion and sedimentation in the Medicine Bow River" (BLM 1987a:147). This area has naturally high rates of erosion, exhibited by deep gullies, steep headcuts in the upper reaches of the watershed, and severe piping along channel banks, which in places has been aggravated by land use practices (BLM 1978). While no erosion control practices have been implemented in the Second and Third Sand Creek watersheds, the management goal is to reduce sedimentation into the Medicine Bow River and thereby improve water quality for fisheries. The causes of water quality impairment in the Medicine Bow River are sediment and silt loading and nutrient enrichment from irrigation and rangeland erosion (Gunstow 1994).

Sediment loads of surface waters tend to vary directly with storm intensity and rate of discharge. High-intensity storms cause high discharge rates and result in larger sediment production from both channel and soil erosion. In 1981/82, total suspended sediment (TSS) concentrations in Third Sand Creek flood waters varied from 1,451 mg/l at a discharge rate of 14.4 cfs to 51,960 mg/l at a discharge of 69 cfs (Vaughn Hansen Associates, Inc. 1982).

Surface water in the Medicine Bow River and Second and Third Sand Creeks varies from a predominately sodium-sulfate type to a mixed cation-sulfate type (i.e., all major cations [sodium, magnesium, and calcium] occur in approximately equal proportions) (Table 3.8). High sulfate concentrations in surface waters result from combined weathering and runoff from shales and fine-grained sediments in the area. During the period from 1964 to 1989, annual TDS concentrations in the Medicine Bow River near Seminoe Reservoir averaged between 600 and 1,100 mg/l. TDS concentrations from individual samples during this period ranged from 110 to

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Table 3.8 Water Quality Parameters for the Medicine Bow River, Second Sand Creek, and Third Sand Creek.[1]

Location/Date	pH (S.U.)	Hardness (mg/l as $CaCO_3$)	Calcium (mg/l)	Magnesium (mg/l)	Sodium (mg/l)	Chloride (mg/l)	Sulfate (mg/l)	Nitrates (mg/l)	TDS[2] (mg/l)	TSS (mg/l)
Medicine Bow River (Hanna) (1983-89 except 1986-87)[3,5]	7.8-9.1	170-820	42-190	16-84	27-150	4.7-64	120-780	0.09-2.88[4]	600-1,100[5]	10-2,090
Third Sand Creek at County Road 3 (5/10/77)[6]	8.2	530	107	64	195	6.7	736	n/a	1,392	n/a
Third Sand Creek at County Road 3 (1980)[7]	8.2-8.5	105-870	40-116	17-65	40-180	<0.1-14	186-640	n/a	350-560	11-2,736
Second Sand Creek (5/10/77)[6]	7.9	746	147	92	127	21.3	800	n/a	1,400	n/a

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[1] According to the Wyoming Department of Agriculture, Analytical Services (1998), good-quality livestock water should not exceed the following criteria:
- Total Dissolved Solids (TDS): 1,000 mg/l;
- Hardness: 100 mg/l;
- Sulfates: 500 mg/l;
- Nitrates as N: 10 mg/l; and
- Sodium: 500 mg/l.

[2] Certain species of livestock can tolerate up to 12,000 mg/l TDS; however, it takes a long time to increase an animal's tolerance to water of high salinity.

[3] USGS 1994.

[4] 1964-1979.

[5] 1964-1989 except 1986-87.

[6] Medicine Valley Engineers, Inc. (1977).

[7] Vaughn Hansen Associates, Inc. (1982).

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1,770 mg/l (Table 3.8). In 1977 and 1980, TDS concentrations on Third Sand Creek were 1,392 mg/l and 358-500 mg/l, respectively--levels fit for human consumption to levels marginal for livestock (Mesilla Valley Engineers, Inc. 1977; Vaughn Hansen Associates, Inc. 1982).

Surface Water Use. Second and Third Sand Creeks are Class 4 waters (WDEQ, Water Quality Division [WQD] 1990), which do not have the hydrologic properties or natural water quality to support use as a fishery but are protected for agricultural and wildlife watering uses (WQD 1990). The Medicine Bow River is a Class 2 water which presently supports, has the potential to support, or includes nursery areas or food sources to support game fish; however, use as a coldwater fishery is only partially supported. It is also suitable for primary contact recreation (i.e., swimming), livestock and wildlife watering, human health value criteria, industry, and irrigation (Gumtow 1994).

Surface Water Rights. There are 23 permitted surface water rights within the CBCPA: seven diversions (ditches), three reservoirs, and 13 stockponds. Stock watering (0.22-6.3 acre-ft) and irrigation (0.35-0.45 cfs) are the primary uses. All water rights are associated with private landowners. An additional 20 surface water rights for irrigation and stock exist within 2-3 mi of the CBCPA (personal communication, 1998, with Daryl Jensen, Western Water Consultants, Inc.).

3.1.9.2 Groundwater

Groundwater Quantity. The Lewis Shale outcrops around the entire Carbon Basin, with the exception of a small area at the basin's northwestern end, forming a bowl-shaped layer of relatively impervious material and thereby separating the overlying aquifer system from regional aquifers (Figure 3.5) (BLM 1979; Vaughn Hansen Associates, Inc. 1982). The Lewis Shale almost completely eliminates hydrologic connection between the CBCPA and the Medicine Bow River. Alluvial aquifers along the Medicine Bow River overlie the Lewis Shale and the Medicine Bow Formation but are not in contact with the Hanna Formation.

There are three aquifer types within the Carbon Basin--alluvial, water table, and artesian. Alluvial aquifers exist along drainages and in valleys in narrow deposits of Quaternary alluvial deposits (BLM 1979). Water levels within the alluvial aquifers vary in response to precipitation and surface flow.

Water table and artesian aquifers exist in the Hanna Formation, which is composed of discontinuous beds of sandstones, shales, and coal. In the vicinity of the CBCPA, the only continuous bed of the Hanna Formation appears to be the Johnson Seam (Vaughn Hansen Associates, Inc. 1982). Overlying sandstone layers or lenses are of variable thickness, discontinuous, and interbedded within silt and shale layers. Sandstone aquifers vary in thickness from a few inches to approximately 25 ft. In areas where sandstone occurs near or at the surface, water table conditions exist within the aquifer. Artesian aquifers occur at depth, where aquifers are typically overlain by impermeable or nearly impermeable shales. Thus, there is very little hydrologic connection between the coal and sandstone aquifers.

The coal seams and adjacent sandstones are very poor aquifers, but may be the principal aquifers in the basin due to their overall continuity (BLM 1979). The coal aquifers yield only a few gallons per minute because permeability is relatively low and is primarily due to joints and fractures within the seams. The overburden, as a whole, is also a very poor aquifer, except near Third Sand Creek where sandstone beds are directly connected with water-bearing alluvial deposits. Even in these areas, however, aquifer yields are relatively low because porosity is limited to channelization within cemented sandstones due to leaching of cementing agents. Table 3.9 presents selected data from aquifer tests within and adjacent to the project area.

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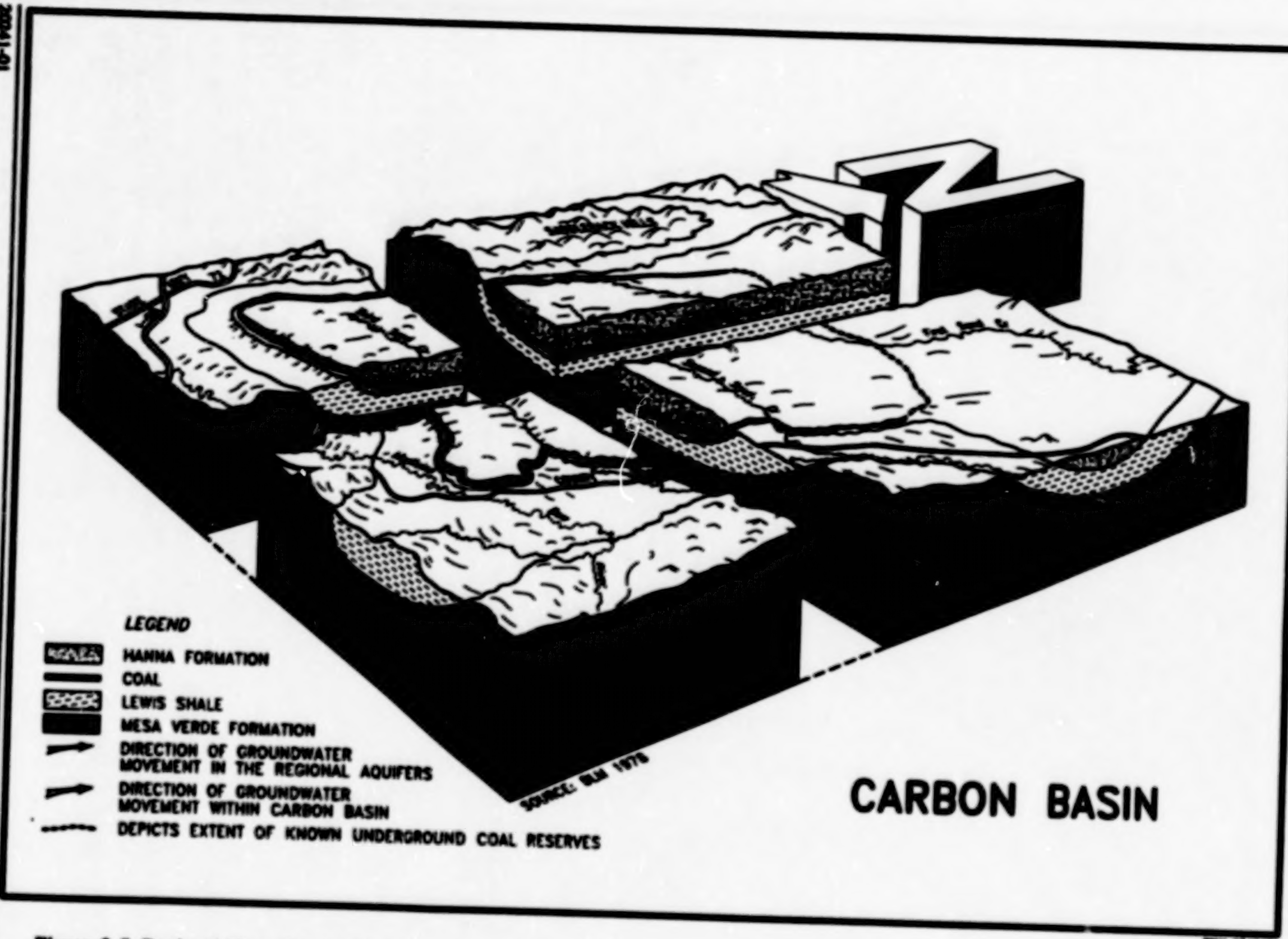
LEGEND
HANNA FORMATION
COAL
LEWIS SHALE
MESA VERDE FORMATION
DIRECTION OF GROUNDWATER MOVEMENT IN THE REGIONAL AQUIFERS
DIRECTION OF GROUNDWATER MOVEMENT WITHIN CARBON BASIN
DEPICTS EXTENT OF KNOWN UNDERGROUND COAL RESERVES
SOURCE: BLM 1978
CARBON BASIN

Figure 3.5 Regional Groundwater System.

Table 3.9 Overburden and Coal Aquifer Transmissivity and Permeability.

Well No.	Aquifer	Transmissivity (gallons/day/ft)	Permeability (ft/day)
MW2-1CU	Coal and overburden	7	0.015
MW36-1C	Coal	3	0.027
MW36-2C	Overburden	7	0.023
MW36-4C	Coal	1	0.008
MW36-5CO	Coal	12	0.031
MW36-6U	Overburden	766	0.602
MW36-7UO	Overburden	579	0.401
MW36-4UO	Overburden	1,443	0.808

Source: Vaughn Hansen Associates, Inc. 1982.

In 1981, the piezometric surface for groundwater in the overburden aquifer was estimated to vary from 6,950 to 7,030 ft above sea level. In the coal aquifer, the piezometric surface was estimated to vary from 6,850 to 7,040 ft above sea level.

The coal and overburden aquifers have very low water storage capacities (storage coefficients of 0.00024 and 0.013, respectively). Seasonal variations in groundwater levels are more pronounced in the overburden zone (up to 5 ft) compared with the coal zone (approximately 2 ft).

Recharge occurs primarily on the basin's southern and eastern rim (defined by the Lewis Shale) and occurs via deep percolation of precipitation (BLM 1979). Regional groundwater movement is to the northeast towards East Allen Lake (Figure 3.5). Narrow bands of alluvial deposits (e.g., along Second and Third Sand Creeks) may occasionally provide recharge for bedrock aquifers, but because these deposits are relatively small they are primarily a source for groundwater discharge, and groundwater flows towards them (Vaughn Hansen Associates, Inc. 1982). Groundwater also discharges through springs and seeps located within the basin. Very little water drains out of the basin.

Coal aquifer recharge results from direct infiltration along the coal outcrop and from downward percolation through shale strata within the overburden aquifer (Vaughn Hansen Associates, Inc. 1982). Recharge rates are slow in the both the overburden and coal aquifer systems (0.15 and 0.02 inches per year). Recharge and discharge rates are approximately equal.

The town of Elk Mountain has a petition for sole source aquifer designation that is currently under consideration by EPA. This will not overlap with the CBCPA and thus is not discussed further in this EIS.

Groundwater Quality. Groundwater quality within the overburden and coal aquifers is generally poor (i.e., suitable for livestock and wildlife watering) (BLM 1979; Vaughn Hansen Associates, Inc. 1982). High sulfate concentrations preclude groundwater use for domestic or agricultural purposes. Water quality is highly variable because the geologic strata are interbedded and discontinuous. Waters within the overburden aquifer include magnesium-calcium-sulphate and sodium-bicarbonate types. In 1981/82, TDS concentrations in the coal and overburden aquifers ranged from 1,690 to 2,170 mg/l; pH varied from 6.9 to 7.7 (Vaughn Hansen Associates, Inc. 1982). TDS concentrations of less than 1,000 mg/l is considered acceptable for human consumption.

Waters within the coal aquifer range from completely mixed (e.g., all cations and anions except chloride in approximately equal concentrations) to a sodium-bicarbonate type near Third Sand Creek. In 1978, TDS concentrations ranged from 672 to 3,904 mg/l in March; 1,160 to 2,936 mg/l in May; 1,124 to 8,084 mg/l in August; and 960 to 7,104 mg/l in December (BLM 1979). In 1981/82, TDS concentrations ranged from 720 to 1,250 mg/l. pH varied from 7.6 to 8.4 (Vaughn Hansen Associates, Inc. 1982). The predominant water type at any given location apparently remains fairly constant.

Groundwater Use. There are 43 permitted wells within the CBCPA and an additional 41 wells within 3.0 mi of the CBCPA (personal communication, 1998, with Daryl Jensen, Western Water Consultants, Inc.). Most wells within the area are used for monitoring, irrigation, and stock watering (Table 3.10).

3.1.10 Noise and Odor

Wind, traffic on I-80 and other roads, occasional aircraft, and animals are the primary sources of ambient noise in the CBCPA. The A-weighted sound pressure level, or A-scale, is used extensively in the U.S. for the measurement of community and transportation noise and is a measure of noise, in A-weighted decibels (dBA), which is directly correlated with some commonly heard sounds (Table 3.11). Noise-sensitive areas in the CBCPA include sage grouse leks during the breeding season, occupied raptor nests, and crucial winter range for pronghorn and mule deer during critical winter periods.

The predominant noise source within the CBCPA is wind, and ambient noise levels are strongly correlated with wind speed (BLM 1995a, 1995b). Average hourly wind speeds increase throughout the morning, peak in early afternoon, and decrease in late afternoon. Ambient noise levels follow a similar pattern, increasing from 30-40 dBA in the morning to 50-60 dBA during the afternoon and decreasing again to 30-40 dBA in the evening. These levels correspond to noise levels of a soft whisper (30 dBA), a quiet office (50 dBA), and normal conversation (60 dBA).

No specific data on odors are available for the CBCPA. Odors present in the area would include the natural odors of vegetation and wildlife and human-caused odors associated with emissions from vehicles and livestock concentration areas. Most odors are likely to be quickly dispersed by wind.

3.1.11 Electric and Magnetic Fields

Electric and magnetic fields (EMFs) have become a public health and safety concern as preliminary studies have demonstrated a possible connection between EMFs and certain diseases, although to date, a direct cause-and-effect relationship has not been determined (Public Utility Commission of Texas 1992; Frey 1993; Sacramento Municipal Utility District [SMUD] 1993). Due to the lack of data on the biological effects of EMFs, no national standard for exposure level has been established whereby a proposed project would be classified as "safe" or a health risk. Some states have established electric or magnetic field standards, but the State of Wyoming does not have standards for either.

Power lines can be a major source of magnetic field exposure throughout a home located close to the line. Typical electric and magnetic field strengths for common transmission lines are given in Table 3.12. One 115-kV power line (occupying approximately 6.0 mi) occurs within the CBCPA and PacifiCorp's 230-kV transmission line is within 2 mi of the project area. These two lines are the only known sources of EMF within or adjacent to the CBCPA.

Table 3.10 Water Rights Within the CBCPA and 2.0- to 3.0-mi Buffer.

Permitted Use	No. Wells Within the CBCPA	No. Wells Outside Permit Area but Within 2.0-3.0 mi of the CBCPA
Monitoring	43	15
Stock Watering	2	11
Domestic	0	5
Miscellaneous	0	6
Municipal	0	2
Total	45	39

Sources: Personal communication, February 1998, with Daryl Jensen, Western Water Consultants, Inc.; Wyoming State Engineer's Office (1998).

Table 3.11 Comparison of Measured Noise Levels with Commonly Heard Sounds.

Source	dBA	Description
Normal breathing	10	Barely audible
Rustling leaves	20	
Soft whisper (at 16 ft)	30	Very quiet
Library	40	
Quiet office	50	Quiet
Normal conversation (at 3 ft)	60	
Busy traffic	70	
Noisy office with machines; factory	80	
Heavy truck (at 49 ft)	90	Constant exposure endangers hearing

Source: Tipler (1991).

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Table 3.12 Typical Electric and Magnetic Field Strengths of Transmission Lines.

Transmission Line Type	Electric Field (kV/m)	Magnetic Field (mG)	
		Maximum[1]	Average[2]
115-kV			
Maximum on ROW	1.0	63	30
Edge of ROW	0.5	14	7
200 ft from center ROW	<0.1	1	<1
230-kV			
Maximum on ROW	2.0	118	58
Edge of ROW	1.5	40	20
200 ft from center ROW	<0.1	4	2
500-kV			
Maximum on ROW	7.0	183	87
Edge of ROW	3.0	62	30
200 ft from center ROW	0.3	7	3

Source: Bonneville Power Administration (BPA) study to characterize nearly 400 transmission lines located in the Pacific Northwest (BPA n.d.).

[1] Under annual peak load conditions (occurs less than 1% of the time).

[2] Under annual average loading conditions.

3.2 BIOLOGICAL RESOURCES

3.2.1 Vegetation

3.2.1.1 Vegetation Communities

Sagebrush shrubland (11,867 acres), mixed shrub/rough breaks (3,508 acres), bottomland shrub (1,346 acres), and grass/subshrub (865 acres) constitute 96% of the total naturally occurring vegetation within the CBCPA (Table 3.13). Approximately 2% of the total project area was previously disturbed by mining and has been reclaimed or is currently disturbed due to roads, pipelines, and abandoned mines. The remaining land area (2% of the CBCPA) consists of bottomland grasslands, playas, reservoirs/stockponds, greasewood flats, hay meadows, and cottonwood bottoms. Appendix A contains the common and scientific name of plant species known to occur in the CBCPA.

The sagebrush shrubland, generally found on rolling uplands with flat to moderately steep slopes, is the dominate vegetation type within the CBCPA. Soils are generally shallow to moderately deep and well-drained. Total vegetation cover averages 52.3% and is composed of 25.9% shrubs and subshrubs, and 25.4% perennial grasses and forbs (see Table 3.13). Big sagebrush is the dominant shrub. Black sagebrush, greasewood, rubber rabbitbrush, and Douglas rabbitbrush are also common. Perennial grasses and grasslike plants include western wheatgrass, bluebunch wheatgrass, Sandberg bluegrass, green needlegrass, Indian ricegrass, and

Table 3.13 Premining Vegetation Types and 1997 Vegetative Cover and Production.[1]

Vegetation Types	Acreage Within CBCPA	Percent of CBCPA	Total Ground Cover (%)[2]	Vegetative Cover (%)	Bare Ground (%)	Shrubs (%)	Subshrubs (%)	Perennial Grasses and Grasslike (%)	Perennial Forbs (%)	Annual Grasses (%)	Annual Forbs (%)	Production (lbs/acre)
Sagebrush shrubland	11,857	65	74.7	52.3	25.3	24.0	1.9	20.7	4.7	0.0	0.3	161.5
Mixed shrub/rough breaks	3,588	19	73.5	36.9	26.5	14.8	4.7	11.7	5.4	0.1	0.2	154.4
Bottomland shrub	1,346	7	86.4	64.7	13.6	43.2	0.4	16.8	2.8	0.4	1.1	226.7
Grass/subshrub	865	5	66.7	46.1	33.3	0.8	23.1	20.4	1.3	0.0	0.1	241.7
Bottomland grassland	22	<1	89.9	71.7	11.1	0.0	0.0	51.0	19.1	0.0	1.6	1,206.3
Playa	69	<1	69.2	46.5	30.8	0.4	2.4	34.3	4.8	0.0	4.7	559.2
Mine reclamation[3]	241	1	–	–	–	–	–	–	–	–	–	–
Disturbed land[3]	159	1	–	–	–	–	–	–	–	–	–	–
Reservior/stockpond[3]	8	<1	–	–	–	–	–	–	–	–	–	–
Greasewood flat[3]	117	1	–	–	–	–	–	–	–	–	–	–
Hay meadow[3]	80	<1	–	–	–	–	–	–	–	–	–	–
Pipeline reclamation[3]	61	<1	–	–	–	–	–	–	–	–	–	–
Cottonwood bottom[3]	17	<1	–	–	–	–	–	–	–	–	–	–
Total acreage	18,380	100	–	–	–	–	–	–	–	–	–	–

Source: Personal communication, February 1998, with Jim Orpet, Intermountain Resources.

[1] Vegetative cover was determined using a point-intercept method along 50-m transects. Production was determined by clipping all plants except annual species and full shrubs rooted within 1-square meter plots.

[2] Includes vegetation, litter, rock, and lichen cover.

[3] Not sampled in 1997.

threadleaf sedge. Hood's phlox is the dominant perennial forb. In 1997, annual vegetation production in the sagebrush shrubland type averaged 161.5 lb/acre. Perennial grasses contributed 87.2% of the annual production. Shrub density averaged 3.1 shrubs/m².

The mixed shrub/rough breaks is associated with rocky outcrops and shallow soils and is the second most common vegetation type within the CBCPA. Total vegetative cover averages 36.9%. Rocks comprise 24.9% of ground cover. Approximately 14.8% of vegetative cover is provided by shrubs, 4.7% by subshrubs, 11.7% by perennial grasses, 5.4% by perennial forbs, and 0.3% by annual species. The dominant shrubs are big sagebrush, antelope bitterbrush, Wood's rose, Gardener's saltbush, snowberry, and rabbitbrush. Predominant grasses include Indian ricegrass, bluebunch wheatgrass, western wheatgrass, and Sandberg bluegrass. Common forbs are prairie thermopsis, Hood's phlox, Hooker's sandwort, and stemless goldenweed. Subshrubs are dominated by shortstem wildbuckwheat and birdsfoot sagewort. Annual vegetative production in 1997 was 154.4 lb/acre (65.6% was from perennial grasses). Shrub density averaged 2.6 shrubs/m².

The bottomland shrub type is found along drainageways, swales, and some slopes. Sites generally have relatively deep soils and above-average moisture from additional runoff or snow accumulation. Vegetative cover averages 64.7%, with 43.2% shrubs, 0.4% subshrubs, 16.8% perennial grasses, 2.8% perennial forbs, and 1.5% annual grasses and forbs. Big sagebrush is the overall dominant plant species, and western wheatgrass is the most common understory species. Other common shrubs are rubber rabbitbrush, Douglas rabbitbrush, snowberry, greasewood, and silver sagebrush. Common perennial grasses and forbs are bluegrasses, green needlegrass, dandelion, western yarrow, and phlox. In 1997, average vegetation production of the bottomland shrub type was a moderate at 226.7 lb/acre, 50.6% of which was provided by perennial grasses. Shrub density averaged 3.3 shrubs/m².

The grass/subshrub type composes 5% of the CBCPA. This type is found on areas with relatively little topographical relief. Soils are relatively deep but many sites are relatively clayey. Vegetative cover in 1997 was 46.1%--perennial grasses comprised 20.4%, shrubs contributed 0.8%, subshrubs contributed 23.1%, perennial forbs contributed 1.3%, and annual grasses and forbs contributed 0.1%. Birdsfoot sagewort and Gardner saltbush were the dominant subshrubs. Western wheatgrass, threadleaf sedge, Sandberg bluegrass, and Indian ricegrass were common perennial grasses. Vegetative production was 241.7 lb/acre, 56.8% of which was provided by subshrubs and 41.7% of which was provided by perennial grasses. Shrub density averaged 4.7 shrubs/m², most of which was provided by subshrubs (e.g., birdsfoot sagewort, Gardner saltbush).

The bottomland grassland vegetation type occurs on <1% of the CBCPA on deep soils in moderately well-drained bottomlands. Soils in some cases are moderately to extremely alkaline. Vegetative cover averages 71.7%. Perennial grasses and forbs were the dominant lifeform with 51.0% and 19.1% cover, respectively. Annual forb cover was 1.6%. Shrubs, subshrubs, and annual grasses were rare in this type. Dominant plant species varied locally but typically included alkali sacaton, aster, inland saltgrass, foxtail barley, western wheatgrass, poverty weed, and common plantain. Herbaceous production was high at 1,246.3 lb/acre, most of which was provided by perennial grasses (61.0%) and forbs (38.9%). Shrub density averaged >0.1 shrub/m².

Playas occupy approximately <1% of the CBCPA and are located in closed basins which pond water during a portion of the year. Some are entirely vegetated while others have significant barren areas where water ponds. Only one playa was observed to contain water throughout most of 1997. Soils are generally clayey, and some sites are relatively alkaline. Vegetative cover averaged

46.5% (Table 3.13). Perennial grasses and grasslike plants comprised 34.3% of cover. The remaining cover was provided by perennial forbs (4.8%) and annual forbs (4.7%). Dominant plant species were western wheatgrass, foxtail barley, and inland saltgrass. Poverty weed, saltwort, and Louisiana sagewort were common in localized areas. Perennial grasses produced 73.7% of the average 559.2 lb/acre herbaceous production in 1997. Shrub density averaged 0.5 shrub/m^2.

Several small areas composed of greasewood flats occur within the CBCPA (1%) on moderately deep and usually alkaline soils. These sites have poor vegetative cover and are highly subject to wind and water erosion. Dominant plant species are black greasewood, Gardner saltbrush, western wheatgrass, Sandberg bluegrass, and bottlebrush squirreltail. This vegetation type was not sampled for cover or production in 1997.

Some abandoned mine areas located on the western edge of the CBCPA were revegetated under the AML program. Reclaimed abandoned mine areas are generally rolling hills with varying aspects and limited topsoil replacement. Wheatgrasses are dominant but Indian ricegrass, green needlegrass, rubber rabbitbrush, fourwing saltbush, and big sagebrush have also become established.

Disturbed lands (see Table 3.13) consist primarily of areas affected by past mining activities that have not been reclaimed. A majority of these sites are located in the western portion of the CBCPA and occupy a total of 159 acres (1%). Topography is variable, ranging from very steep to relatively flat. Topsoil is generally absent but some vegetation has become established in many areas. Dominant plant species were big sagebrush, rubber rabbitbrush, greasewood, bluebunch wheatgrass, and curlycup gumweed. One pit pond is located within these unreclaimed mined areas. Also associated with past mining activities are roads and disturbances created by a small townsite created for the mines.

Several pipelines cross the southwestern corner of the study area within one corridor that has been reclaimed and would not be affected by mining activities. Topsoil in the corridor consists of mixed materials that were removed and replaced during pipeline construction. Dominant plant species were western wheatgrass, thickspike wheatgrass, bluebunch wheatgrass, and green needlegrass. Crested wheatgrass was common on some sites. Big sagebrush, rubber rabbitbrush, and Hood's phlox were also common species.

Hay meadows are located along the southeastern edge of the CBCPA. They are irrigated in the spring and early summer and are generally cut and baled starting in late July through early September. Dominant plant species varied with site but smooth brome, timothy, orchard grass, and wheatgrasses were most common. Alfalfa hay is not produced on any of these meadows. Hay meadows would not be affected by mining activities.

The cottonwood bottom vegetation type is only found along the Medicine Bow River where the river crosses the southeastern corner of the CBCPA. Soils vary considerably from deep well-drained soils to gravel bars with no topsoil. Dominant plant species were narrowleaf cottonwood and willows. The understory consisted of a variety of grasses, sedges, and forbs. This type would not be affected by mine development or operation.

3.2.1.2 Noxious Weeds

A few species of noxious weeds are known to occur in the area, including white top and Canada thistle (personal communication, April 1998, with Jim Orpet, Intermountain Resources). Russian knapweed and spotted knotweed occur in the general area (personal communication, April 1998, with Susan Foley, BLM).

3.2.1.3 Wetlands

There are more than 30 potential wetlands (approximately 150 acres) within the CBCPA (Figure 3.4). Most wetlands occur adjacent to the

Medicine Bow River (up to 0.5 mi from the main channel) where periodic flooding has caused the development of wetland hydrologic, vegetative, and soils characteristics. Approximately 30 acres of wetlands (impoundments and springs) occur along Second and Third Sand Creeks and are classified as temporarily, seasonally, or semipermanently flooded. Additionally, 23 potential wetlands, most of which are less than 1 acre in size, occur in small depressions and playas throughout the CBCPA. Sevenmile Lake, which is located in the western part of the CBCPA, occupies approximately 80 acres and is semi-permanently or permanently flooded. Fiddler's Green Reservoir, located in the northwestern corner of the CBCPA, occupies approximately 30 acres and is temporarily or semipermanently flooded.

Wetlands within the CBCPA have the following values and functions.

- They are important sites for natural biological functions including food chain production; wildlife and vegetation habitat; and nesting, rearing, and resting sites for aquatic and terrestrial species.
- They serve as storage areas for storm and flood waters and sediment.
- They serve as groundwater discharge areas that maintain minimum base flows important to aquatic resources and groundwater recharge areas, allowing water to seep and recharge underlying aquifers.
- They are natural watering areas for wildlife in an arid environment.
- They filter pollutants out of the hydrologic system.

All necessary permits would be obtained prior to disturbing any wetlands. Wetlands would be avoided, where feasible, or mitigated to ensure no net loss of wetlands.

Along the alternate transportation corridors, most wetlands are less than 1 acre and occur in small depressions and playas or are associated with drainages and are classified as semipermanently, seasonally, or temporarily flooded. Most potential wetlands along the transportation corridors are associated with Carbon, Percy, First Sand, Second Sand, Third Sand, Jim, and Standpipe Draw Creeks. East Allen Lake, a 250-acre perennial lake, is located southwest of Medicine Bow, Wyoming, and is the largest body of water in the corridor analysis area.

In this area, wetland vegetation is typically composed of 80% grasses and grasslike species, 10% forbs, and 10% woody plants (Soil Conservation Service 1988). Tufted hairgrass, northern reedgrass, and Nebraska sedge typically dominate the grass and grasslike species. Common forb species include arrowgrass, blue-eyed grass, elephanthead, horsetail, and water hemlock. Willow, rose, and water birch are the most common woody species. Vegetative cover averages 85 to 100%, and production in normal years on wetlands in excellent condition averages 5,000 lb/acre.

3.2.2 Wildlife and Fisheries

The topography, soils, water resources, and vegetation within the CBCPA provide habitats used by numerous wildlife species as discussed below. Wildlife field observation data for the CBCPA and an approximate 1.0- to 2.0-mi buffer were collected by Intermountain Resources between January 1997 and September 1997 as part of the permitting process (Figure 3.6). These surveys were conducted in accordance with Appendix B of the WDEQ, Land Quality Division (LQD) Coal Rules and Regulations and LQD Guideline No. 5 (for passerine birds and small mammals) as agreed upon with WGFD. Preconstruction and monitoring data collected between February 1994 and spring 1998 for the adjacent SeaWest Wind Plant are also included where appropriate (BLM 1995a, 1995b; TRC Mariah 1995; Johnson et al. 1997, 1998). Appendix A contains the common and scientific names of animal species known to occur or potentially occurring on or adjacent to the CBCPA.

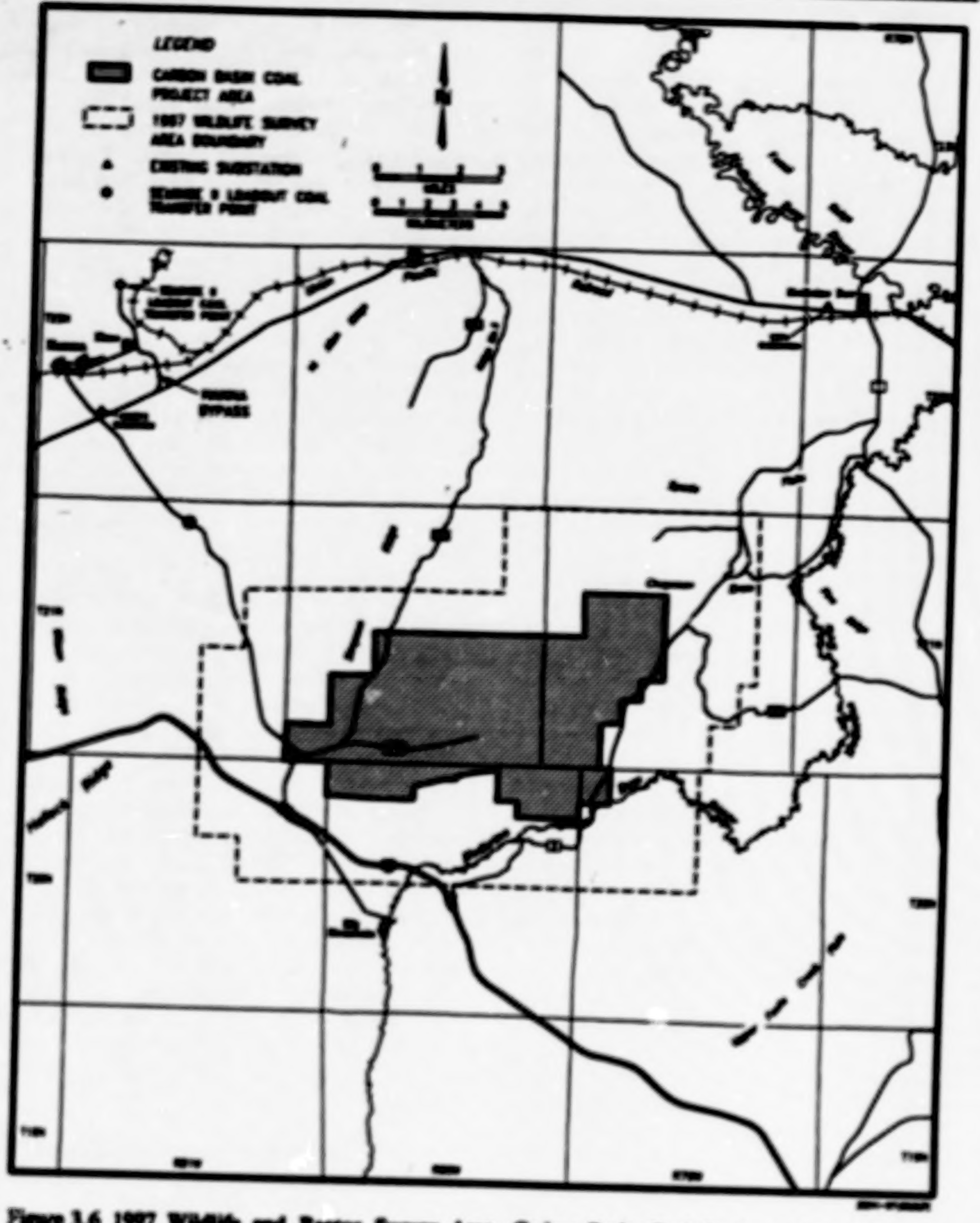
LEGEND
CARBON BASIN COAL PROJECT AREA
1997 WILDLIFE SURVEY AREA BOUNDARY
EXISTING SUBSTATION
SEMINOE II LOADOUT COAL TRANSFER POINT
N
MILES
KILOMETERS
HANNA BYPASS

Figure 3.6 1997 Wildlife and Raptor Survey Area, Carbon Basin Coal Project, Carbon County, Wyoming.

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3.2.2.1 Big Game/Other Mammals

Four big game mammal species occur on or adjacent to the CBCPA: pronghorn, mule deer, white-tailed deer, and elk. Moose, although they may be rare visitors to drainages in the area (e.g., Rock Creek, Medicine Bow River), do not regularly occur within the CBCPA (personal communication, August 12, 1997, with Bob Lanka, Wildlife Management Coordinator, WGFD, Laramie); therefore, they will not be addressed further in this EIS. Specific information concerning big game hunting and harvest in the CBCPA is provided in Section 3.5.3.

Pronghorn. Pronghorn in the CBCPA are part of the Medicine Bow Herd Unit (Figure 3.7), which includes Hunt Areas 41, 42, and 46 through 48 and occurs north of I-80. The WGFD population objective for this herd is 45,000 animals, and the estimated posthunt population in 1996 was 25,000, or 56% of the objective (WGFD 1997a) (Table 3.14). The 5-year population average (1992-1996) was approximately 26,000 animals, or 58% of objective. High harvest levels, severe winter weather, drought, cold wet spring weather, and increased predation, among other factors, have contributed to the overall decline of the pronghorn population during the past several years (WGFD 1997a). The Medicine Bow antelope herd population level is stagnant to slowly increasing as a result of depressed fawn production; therefore, the WGFD has reduced the number of licenses in recent years in an attempt to allow the population to increase to objective (personal communication, August 12, 1997, with Bob Lanka, Wildlife Management Coordinator, WGFD, Laramie).

Winter/yearlong range is range which is used yearlong, but which, during winter, has a substantial influx of animals from other seasonal ranges (WGFD n.d.). Crucial winter/yearlong range is defined as winter/yearlong range that has been documented as the determining factor in a population's ability to maintain itself at a desired level over the long-term (WGFD n.d.). The CBCPA is located in the southern tip of a large crucial winter yearlong range that extends from I-80 in a wide band through the Carbon Basin north along both sides of the Medicine Bow River to well north of Medicine Bow (Figure 3.7). The majority (approximately 95% or 17,367 acres) of the CBCPA is considered crucial winter/yearlong pronghorn range (Table 3.15, Figure 3.7). The remainder of the CBCPA consists of 789 acres of winter/yearlong range (4% of the CBCPA) and 204 acres (1%) of spring/summer/fall range, which is generally used between May 1 and November 30 (WGFD n.d.).

The 17,367 acres of pronghorn crucial winter/yearlong range within the CBCPA represent approximately 3.7% of the total crucial winter/yearlong range for the Medicine Bow Herd. Approximately 0.2% (789 acres) of the winter/yearlong range and less than 0.1% (204 acres) of the spring-summer-fall range for the Medicine Bow Herd is contained within the CBCPA.

Aerial surveys conducted during 1995-1996 in conjunction with the proposed SeaWest Wind Plant indicate that the heaviest periods of pronghorn use on the CBCPA may be early winter (i.e., November-December) and spring (i.e., March-May), with populations ranging from <0.125 to 2.500 and from 0.125 to 2.000 pronghorn/km^2, respectively. Densities were estimated at <0.125-1.000 pronghorn/km^2 during January and February and were lowest during June (<0.125-0.500) (Johnson et al. 1997). Big game surveys conducted by Intermountain Resources in January/February, April, June, and August 1997 also indicated heaviest use of the CBCPA by pronghorn in winter, with 891 of 1,597 observations (56%) recorded during the January/February survey. Observations were second highest in August (23%), followed by April (12%) and June (9%) (Intermountain Resources 1997).

The timing of seasonal movements and the extent to which crucial winter/yearlong range is used are dependent on weather and snow depth (Yoakum 1978; Guenzel 1986; Deblinger 1988). Although no specific seasonal movement patterns for

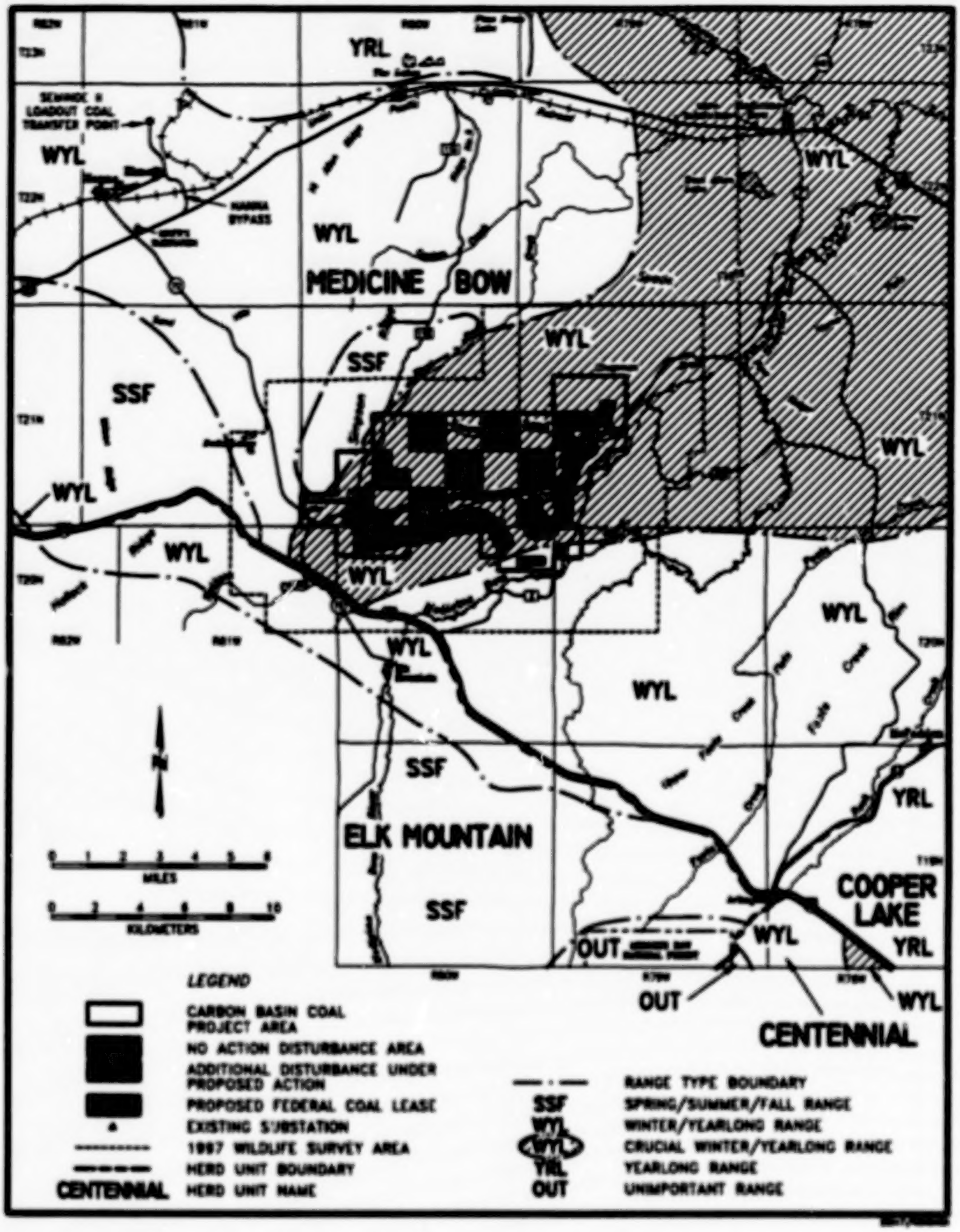
YRL
SEMINOE II LOADOUT COAL TRANSFER POINT
WYL
HANNA BYPASS
MEDICINE BOW
SSF
ELK MOUNTAIN
COOPER LAKE
OUT
CENTENNIAL
MILES
KILOMETERS
0 1 2 3 4 5 6
0 2 4 6 8 10
LEGEND
CARBON BASIN COAL PROJECT AREA
NO ACTION DISTURBANCE AREA
ADDITIONAL DISTURBANCE UNDER PROPOSED ACTION
PROPOSED FEDERAL COAL LEASE
EXISTING SUBSTATION
1997 WILDLIFE SURVEY AREA
HERD UNIT BOUNDARY
CENTENNIAL HERD UNIT NAME
RANGE TYPE BOUNDARY
SSF SPRING/SUMMER/FALL RANGE
WYL WINTER/YEARLONG RANGE
WYL CRUCIAL WINTER/YEARLONG RANGE
YRL YEARLONG RANGE
OUT UNIMPORTANT RANGE

Figure 3.7 Pronghorn Herd Units and Range Types, Carbon Basin Coal Project Area and 1- to 2-mi Buffer.

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Table 3.14 Selected Big Game Herd Unit Attributes.

Species/Herd Unit	Population Objective	1996 Post-hunt Population	1996 Population as % of Objective	5-Year Population Average (1992-1996)	Population Average as % of Objective
Pronghorn					
Medicine Bow Herd	45,000	25,000	56	26,000	58
Mule Deer					
Sheep Mountain Herd	15,000	13,000-15,000	87-100	13,000	87
Platte Valley Herd	20,000	14,000-16,000	70-80	15,000	75
White-Tailed Deer					
Laramie River Herd	1,000	1,000+	100+	Unknown	Unknown
Elk					
Snowy Range Herd	4,900	7,000	143	7,000	143

Source: WGFD 1997a; personal communication, August 12, 1997, with Bob Lanka, Wildlife Management Coordinator, WGFD.

pronghorn within the CBCPA have been described by the WGFD, aerial surveys conducted by Western EcoSystems Technology (WEST) in 1995-1996 indicate a roughly circular pattern of use within the CBCPA, with early winter use highest in the south-central portion of the area, followed by a shift to the northeast (i.e., north of Third Sand Creek) during January and February (Johnson et al. 1997). Highest pronghorn use in the Carbon Basin was observed 1-3 mi northeast of the CBCPA during the winter in 1995 and 1998, while in the spring and summer of 1995 and 1997, use on the CBCPA and surrounding area was approximately equivalent (Johnson et al. 1998). During a January/February 1997 survey, Intermountain Resources also noted heavy use of crucial wintering range in the northeastern portion of the CBCPA, with 63% of the winter observations noted in that area. The remainder of winter observations were scattered throughout the CBCPA (Intermountain Resources 1997). From March through May 1996, Johnson et al. (1997) indicated the locus of highest use was the north-central portion of the CBCPA, with many of the animals apparently moving southwest and off of the CBCPA by June.

It is likely that pronghorn move to the crucial winter/yearlong range in the CBCPA and adjacent areas especially during severe winters and during periods of severe weather within otherwise normal winters. Ryder and Irwin (1987) determined that winter habitat selection by pronghorn in south-central Wyoming was correlated with the density and height of big sagebrush and black greasewood in protected terrain. Sagebrush shrubland is the dominant vegetation type in the CBCPA and adjacent areas (see Table 3.13), and it provides areas of quality winter habitat for pronghorn. In all seasons, and particularly during winter, the majority of pronghorn observations during 1997 surveys were recorded in sagebrush shrubland (Intermountain Resources 1997).

Mule Deer. Mule deer in the CBCPA are part of two herd units: the Sheep Mountain Herd Unit,

Table 3.15 Acreage and Percentage of Wildlife Habitats Within the CBCPA.

Wildlife Resources	Acreage of Wildlife Habitat Within the CBCPA	% of the CBCPA
Pronghorn Antelope		
Medicine Bow Herd		
Crucial winter/yearlong range	17,367	95
Spring/summer/fall range	204	1
Winter/yearlong range	789	4
Mule Deer		
Sheep Mountain Herd		
Crucial winter/yearlong range	4,647	25
Winter/yearlong range	13,633	74
Platte Valley Herd		
Winter/yearlong range	80	<1
White-tailed Deer		
Laramie River Herd		
Yearlong range	800	5
Elk		
Snowy Range Herd		
Crucial winter/yearlong	0	0
Winter/yearlong range	18,280	>99
Raptors		
Potential habitat[1]	18,360	100
Sage Grouse		
Probable nesting habitat[2]	14,320	78
Potential breeding habitat[3]	500	3

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[1] Assumes the entire CBCPA is suitable raptor habitat.
[2] Areas within 2.0 mi of known lek sites on or adjacent to the CBCPA.
[3] Areas within 0.25 mi of known lek sites on or adjacent to the CBCPA.

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which comprises more than 99% of the CBCPA, and the Platte Valley Herd Unit, which occupies less than 100 acres (less than 1%) in the extreme southwestern portion of the CBCPA (i.e., west of State Highway 72) (Figure 3.8).

The Sheep Mountain Herd Unit contains Hunt Areas 61 and 74 through 77. The WGFD population objective for the Sheep Mountain Herd is 15,000 animals, and the estimated posthunt population in 1996 was 13,000-15,000 animals, or 87-100% of objective (WGFD 1997a) (see Table 3.14). The 5-year population average (1992-1996) was approximately 13,000 animals or 87% of objective. The current population trend for the Sheep Mountain Herd appears to indicate a slight increase in numbers (personal communication, August 12, 1997, with Bob Lanka, Wildlife Management Coordinator, WGFD, Laramie).

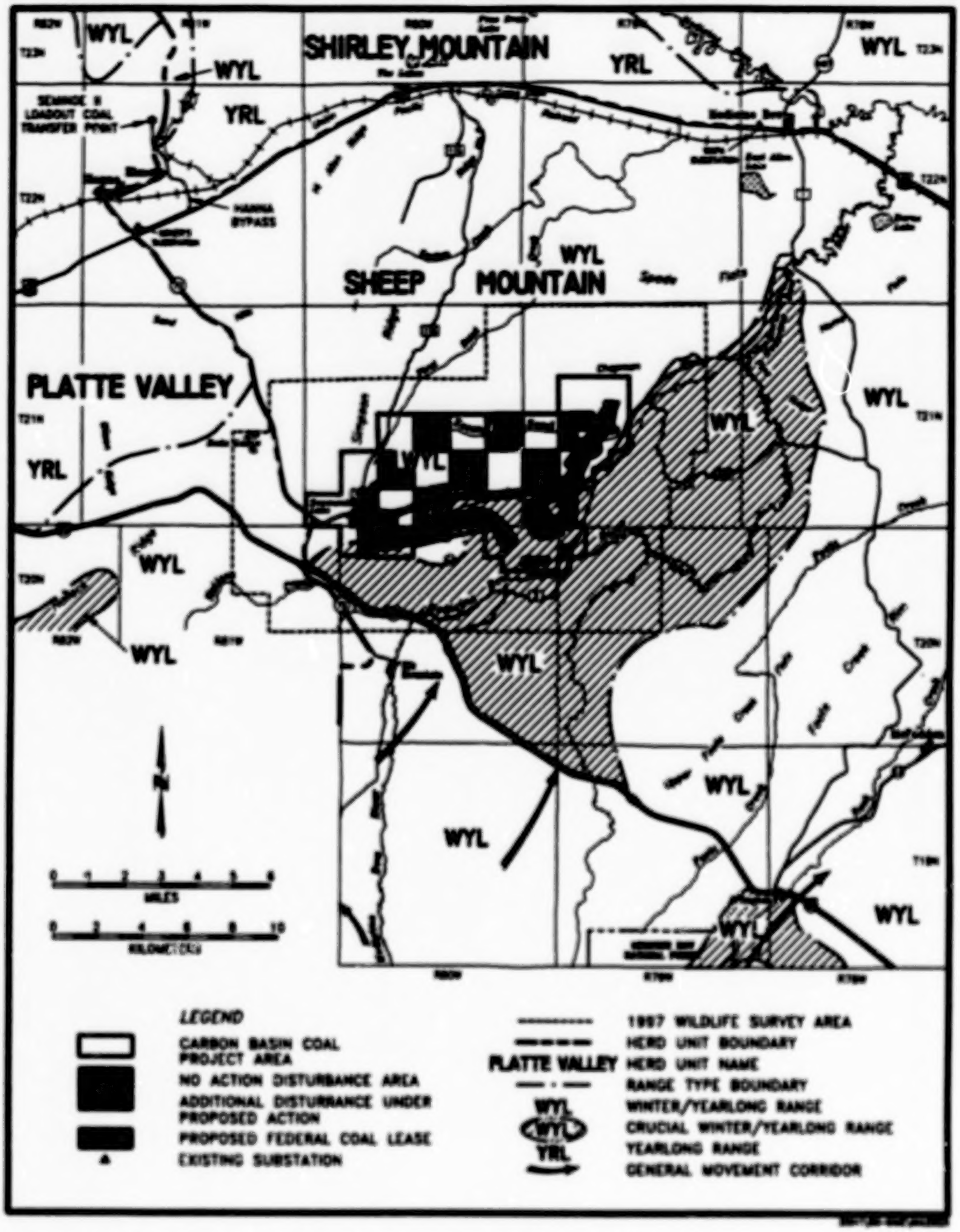
The Platte Valley Herd Unit contains Hunt Areas 78 through 81, 83, and 161. The WGFD population objective for the herd is 20,000 mule deer. The estimated 1996 posthunt population for the herd was 70-80% of objective or 14,000-16,000 animals. The 5-year population average (1992-1996) for the herd was approximately 15,000 deer, or 75% of objective. The Platte Valley Herd population appears to be slowly increasing, but low fawn production has hindered population growth (personal communication, August 12, 1997, with Bob Lanka, Wildlife Management Coordinator, WGFD, Laramie).

Mule deer crucial winter/yearlong range occurs in the southeastern portion of the CBCPA, primarily south of Third Sand Creek (Figure 3.8). The remainder of the CBCPA is classified as winter/yearlong range. Oedekoven and Lindzey (1987) determined that mule deer in southwestern Wyoming tended to use sagebrush habitats at lower elevations in areas with the least snow depth and cover during winter. Mule deer generally avoid areas where snow depth is greater than 18 inches (Gilbert et al. 1970). In all seasons, and particularly during winter, the majority of mule deer observations during 1997 big game surveys were recorded in sagebrush shrubland (Intermountain Resources 1997).

The 4,647 acres of mule deer crucial winter/yearlong range within the CBCPA represent approximately 2.9% of this range type for the Sheep Mountain Herd Unit. About 2.0% (13,633 acres) of the winter/yearlong range for the Sheep Mountain Herd is located within the CBCPA. The CBCPA encompasses less than 0.1% (80 acres) of the mule deer winter/yearlong range for the Platte Valley Herd Unit.

Crucial winter/yearlong range within the CBCPA is associated with the riparian habitat along Third Sand Creek and the Medicine Bow River. Although specific mule deer migration patterns within the CBCPA are not known, during winter months, mule deer generally migrate onto crucial winter range in the vicinity of the CBCPA from the south (i.e., across I-80) (WGFD 1995) (see Figure 3.8). Big game surveys conducted by Intermountain Resources in January/February, April, June, and August 1997 indicated heaviest use of the CBCPA by mule deer in winter, with 64 of 127 observations (50%) recorded during the January/February survey. Approximately 50% of the winter observations occurred in crucial winter range. Observations were second highest in April (36%), followed by August (10%) and June (4%) (Intermountain Resources 1997).

__White-tailed Deer__. White-tailed deer within the CBCPA belong to the Laramie River Herd Unit, which consists of Hunt Areas 70 through 81, 83, and 161 (WGFD 1997a). The WGFD population objective for this herd is 1,000 animals, and the 1996 posthunt population was estimated at 1,000 or more white-tailed deer, or 100+% of objective (see Table 3.14). The estimated 5-year population average (1992-1996) is unknown. The population of the Laramie River Herd is likely increasing due, in part, to the lack of access for harvest (personal communication, August 12, 1997, with Bob Lanka, Wildlife Management Coordinator, WGFD, Laramie).


WYL
SHIRLEY MOUNTAIN
YRL
WYL
SEMINOE II LOADOUT COAL TRANSFER POINT
YRL
HANNA BYPASS
SHEEP MOUNTAIN
WYL
PLATTE VALLEY
YRL
WYL
WYL
WYL
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WYL
WYL
WYL
WYL
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WYL
T23N
T22N
T21N
T20N
T19N
R82W
R81W
R80W
R79W
R78W
N
MILES
KILOMETERS
0 1 2 3 4 5 6
0 2 4 6 8 10
LEGEND
CARBON BASIN COAL PROJECT AREA
NO ACTION DISTURBANCE AREA
ADDITIONAL DISTURBANCE UNDER PROPOSED ACTION
PROPOSED FEDERAL COAL LEASE
EXISTING SUBSTATION
1997 WILDLIFE SURVEY AREA
HERD UNIT BOUNDARY
PLATTE VALLEY HERD UNIT NAME
RANGE TYPE BOUNDARY
WYL WINTER/YEARLONG RANGE
WYL CRUCIAL WINTER/YEARLONG RANGE
YRL YEARLONG RANGE
GENERAL MOVEMENT CORRIDOR

Figure 3.8 Mule Deer Herd Units and Range Types, Carbon Basin Coal Project Area and 1- to 2-mi Buffer.

Dense deciduous riparian communities are the favored habitat of white-tailed deer (Clark and Stromberg 1987). In the areas within and adjacent to the CBCPA, white-tailed deer habitat is restricted to a corridor along the Medicine Bow River (Figure 3.9). This area encompasses approximately 800 acres (5% of the CBCPA) and comprises approximately 1.7% of the yearlong range in the Laramie River Herd Unit (see Table 3.15).

White-tailed deer movement within and adjacent to the CBCPA occurs along the Medicine Bow drainage and adjacent floodplains and wet meadows. Seasonal movement likely is limited in extent and consists of localized shifts (i.e., 10 to 20 mi) within the riparian corridors (Halls 1978). Only six white-tailed deer were recorded during 1997 big game surveys conducted by Intermountain Resources. Three observations each were recorded in the April and August surveys, and all individuals were within cottonwood river bottoms adjacent to the CBCPA (Intermountain Resources 1997).

Elk. Elk in the CBCPA are part of the Snowy Range Herd Unit, which includes Hunt Areas 8 through 12, 110, and 114 (WGFD 1997a) (Figure 3.10). The WGFD population objective for the Snowy Range Herd is 4,900 animals, and the estimated 1996 posthunt population was approximately 7,000 elk or 143% of objective (see Table 3.14). The 5-year population average (1992-1996) was approximately 7,000 animals or 143% of objective. The population trend for the Snowy Range Herd likely is stable to increasing slightly, with insufficient female harvest to decrease the population (personal communication, August 12, 1997, with Bob Lanka, Wildlife Management Coordinator, WGFD, Laramie).

Elk winter range is generally associated with foothills, rugged terrain, and washes located within sagebrush-grassland habitats (Lyon and Ward 1982). Winter range is that range used by a population or portion of a population annually in substantial numbers only during winter (WGFD n.d.).

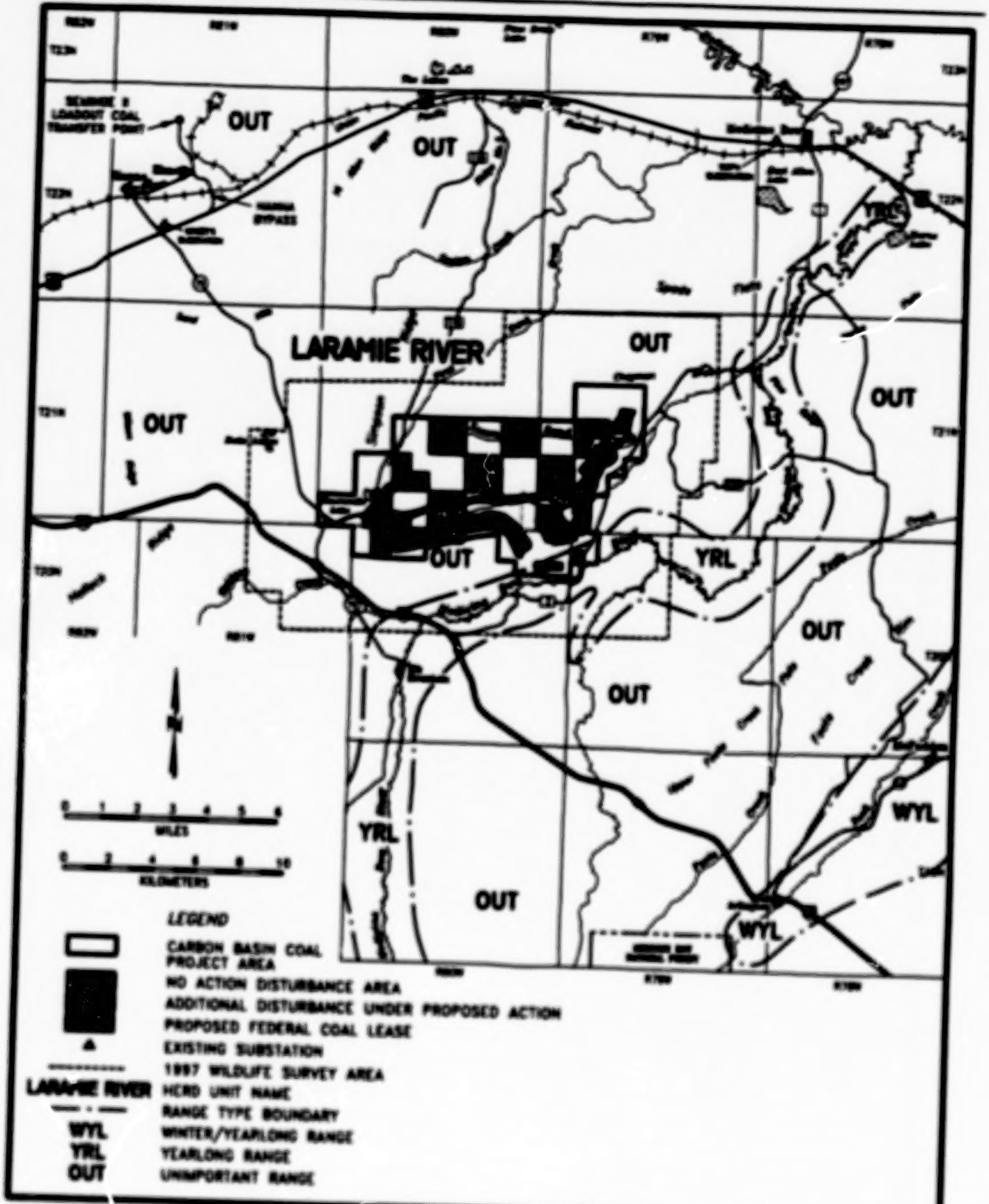
With the exception of less than 100 acres west of State Highway 72, all of the CBCPA is considered winter/yearlong habitat for the Snowy Range Herd Unit (see Table 3.15). The remainder of the CBCPA is outside of any elk herd unit and is considered unimportant to elk. The approximately 18,280 acres of elk winter/yearlong range within the CBCPA represents approximately 3.5% of this range type within the Snowy Range Elk Herd. During 1997 big game surveys of the CBCPA, only five observations of elk were recorded, all of which were observed in sagebrush shrubland during the winter (Intermountain Resources 1997).

Other Mammals. Based on field observations (TRC Mariah 1995; Intermountain Resources 1997; WGFD 1997b) and range and habitat preference (Clark and Stromberg 1987; Luce et al. 1997), 67 mammal species are known to occur or are likely to occur in the vicinity of the CBCPA (Appendix A).

Predator species known to occur or potentially occurring in the area are coyote, red fox, swift fox, gray fox, black bear, raccoon, ermine, long-tailed weasel, black-footed ferret, mink, badger, western spotted skunk, striped skunk, mountain lion, and bobcat (Clark and Stromberg 1987; TRC Mariah 1995; Intermountain Resources 1997; Luce et al. 1997).

Lagomorph species include desert cottontail, mountain cottontail, black-tailed jackrabbit, and white-tailed jackrabbit (Clark and Stromberg 1987; TRC Mariah 1995; Intermountain Resources 1997; Luce et al. 1997).

Sciurids (i.e., squirrels) known to occur or potentially occurring within the CBCPA include yellow pine, least, and Uinta chipmunks; yellow-bellied marmot; Wyoming, thirteen-lined, and golden-mantled ground squirrels; white-tailed prairie dog; and eastern fox and red squirrels (Clark and Stromberg 1987; TRC Mariah 1995; Intermountain Resources 1997; Luce et al. 1997). Other rodents in the area include northern pocket gopher, olive-backed and silky pocket mice, Ord's kangaroo rat, beaver, western harvest mouse, deer


SEMINOE II LOADOUT COAL TRANSFER POINT
HANNA BYPASS
OUT
OUT
LARAMIE RIVER
OUT
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OUT
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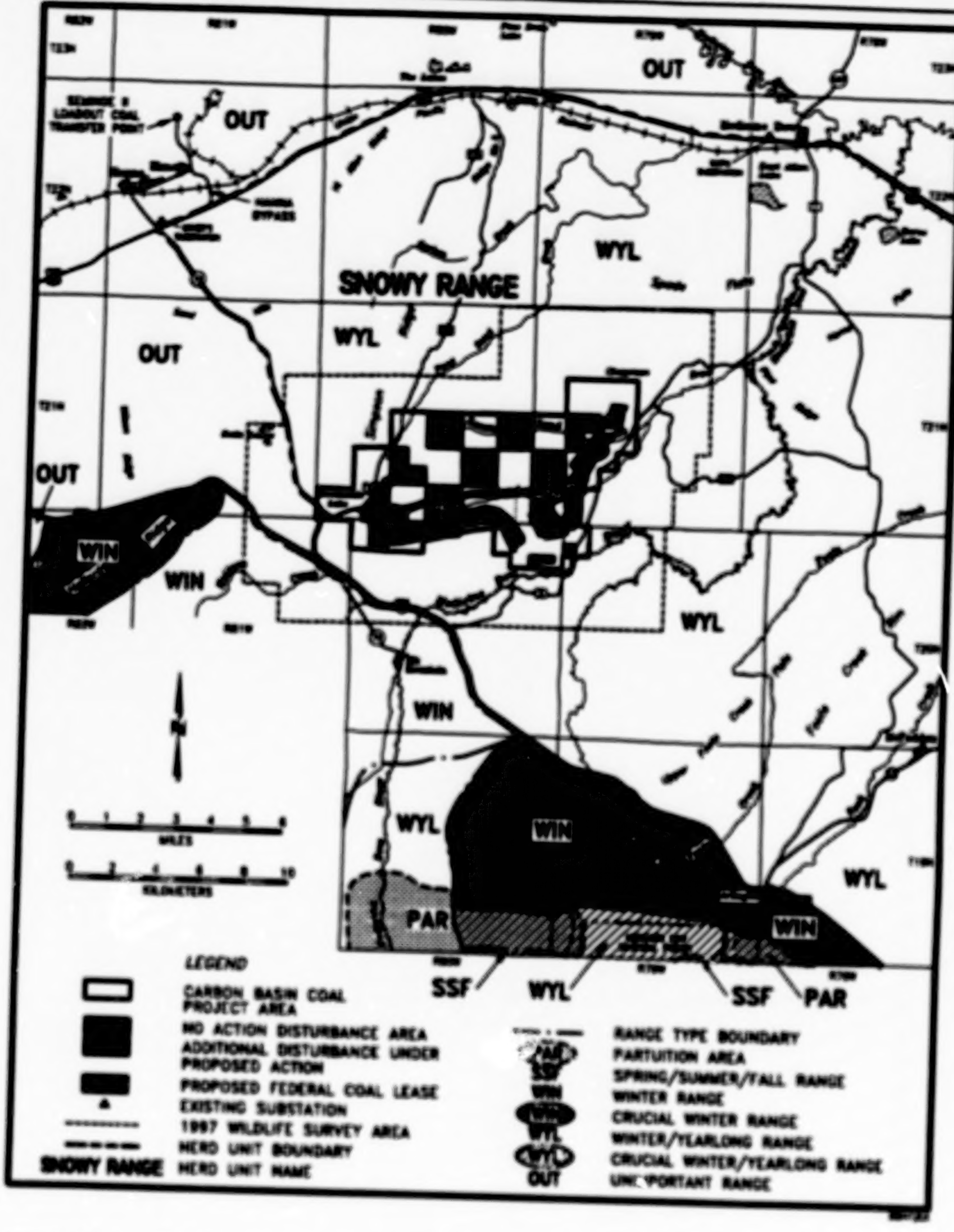
N
0 1 2 3 4 5 6
MILES
0 2 4 6 8 10
KILOMETERS
LEGEND
CARBON BASIN COAL PROJECT AREA
NO ACTION DISTURBANCE AREA
ADDITIONAL DISTURBANCE UNDER PROPOSED ACTION
PROPOSED FEDERAL COAL LEASE
EXISTING SUBSTATION
1997 WILDLIFE SURVEY AREA
LARAMIE RIVER HERD UNIT NAME
RANGE TYPE BOUNDARY
WYL WINTER/YEARLONG RANGE
YRL YEARLONG RANGE
OUT UNIMPORTANT RANGE

Figure 3.9 White-tailed Deer Herd Units and Range Types, Carbon Basin Coal Project Area and 1- to 2-mi Buffer.


OUT
OUT
OUT
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WYL
WYL
WYL
WYL
WYL
SNOWY RANGE
WIN
WIN
WIN
WIN
WIN
PAR
SSF
WYL
SSF
PAR
MILES
KILOMETERS
LEGEND
CARBON BASIN COAL PROJECT AREA
NO ACTION DISTURBANCE AREA
ADDITIONAL DISTURBANCE UNDER PROPOSED ACTION
PROPOSED FEDERAL COAL LEASE
EXISTING SUBSTATION
1997 WILDLIFE SURVEY AREA
HERD UNIT BOUNDARY
SNOWY RANGE HERD UNIT NAME
RANGE TYPE BOUNDARY
PAR PARTUITION AREA
SSF SPRING/SUMMER/FALL RANGE
WIN WINTER RANGE
WIN CRUCIAL WINTER RANGE
WYL WINTER/YEARLONG RANGE
WYL CRUCIAL WINTER/YEARLONG RANGE
OUT UNIMPORTANT RANGE

Figure 3.10 Elk Herd Units and Range Types, Carbon Basin Coal Project Area and 1- to 2-mi Buffer.

mouse, white-footed mouse, northern grasshopper mouse, bushy-tailed woodrat, several species of voles (i.e., southern red-backed, heather, montane, long-tailed, prairie, and sagebrush), muskrat, western jumping mouse, and porcupine. Several species of shrews (i.e., masked, pygmy, dusky, dwarf, water, and Merriam's) and bats (i.e., pallid bat, little brown myotis, long-legged myotis, fringed myotis, small-footed myotis, Townsend's pale big-eared bat, big brown bat, and hoary bat) also are known to occur or may occur on the CBCPA (Clark and Stromberg 1987; personal communication, August 15, 1997, with Bob Luce, Nongame Biologist, WGFD) (Appendix A).

3.2.2.2 Birds

Raptors. All raptors and their nests are protected from take or disturbance under the *Migratory Bird Treaty Act* (16 United States Code [USC] 701-715) and Wyoming Statute (WS) (WS 23-1-101 and 23-3-108). Certain species are also afforded protection under the *Bald Eagle Protection Act* (16 USC 668-668dd) and *Endangered Species Act* (ESA) (16 USC 1531 et seq.).

The entire CBCPA is considered suitable habitat for raptor hunting, foraging, and perching. Raptor species observed within or adjacent to the CBCPA include turkey vulture, osprey, bald eagle, northern harrier, sharp-shinned hawk, northern goshawk, broad-winged hawk, Swainson's hawk, red-tailed hawk, ferruginous hawk, rough-legged hawk, golden eagle, American kestrel, merlin, peregrine falcon, prairie falcon, great horned owl, western burrowing owl, short-eared owl, and northern saw-whet owl (TRC Mariah 1995; Intermountain Resources 1997; WGFD 1997b). Other raptor species potentially occurring within or adjacent to the CBCPA are Cooper's hawk, barn owl, and long-eared owl (Scott 1987; Russell 1990; WGFD 1994; TRC Mariah 1995; Luce et al. 1997). Most breeding species in the area migrate south to more hospitable climates during the winter; however, golden eagles, bald eagles, and great horned owls remain year-round. Rough-legged hawks move into the CBCPA during the winter and migrate north during the breeding season. Peregrine falcons have been observed hunting adjacent to the CBCPA (TRC Mariah 1995).

One hundred seventy-five intact raptor nests were located within the 59,225-acre (94-mi^2) wildlife survey area in 1997 (see Figures 3.6 and 3.11), for a total density of 1.86 nests per mi^2 and 0.32 active nest per mi^2 (Intermountain Resources 1997). Densities reported in 1995 for the adjacent 192-mi^2 Simpson Ridge area were approximately 0.75 nest per mi^2 (0.[illegible] active nest per mi^2) (BLM 1995a; Thomas et al. 1997); in 1992, a total nest density of 0.78 nest per mi^2 was reported for a nearby coalbed methane project (Mariah Associates, Inc. 1992); and in 1989, data extrapolated from raptor surveys at several coal mines near Hanna, Wyoming, indicated a nest density of 0.48 nest mi^2 (Mariah Associates, Inc. 1989; BLM 1995a). Densities of active nests were not reported for the latter two areas.

Seventy-four of the 175 nests located in 1997 were within the CBCPA and 101 nests were in the 1- to 2-mi buffer. Eighty-three (47%) of the known nests within the survey area were ferruginous hawk nests. Red-tailed hawk nests were the second most common (35 nests), followed by golden eagle (26), prairie falcon (12), Swainson's hawk (5), great horned owl (4), bald eagle (3), and American kestrel (1). Six nests of unknown species also were recorded within the 1997 raptor nest survey area (Intermountain Resources 1997).

Of the 30 known active raptor nests observed during the survey, 33% (10) were red-tailed hawk nests. The remaining active nests include ferruginous hawk, golden eagle, prairie falcon, and great horned owl (four nests each); Swainson's hawk (two nests); and bald eagle and American kestrel (one nest each) (Table 3.16). Overall, 53% (16 nests) were known to be successful (i.e., fledged young); productivity for 27% (8 nests) was unknown. Productivity data for the 30 nests active in 1997 are presented in Table 3.17.

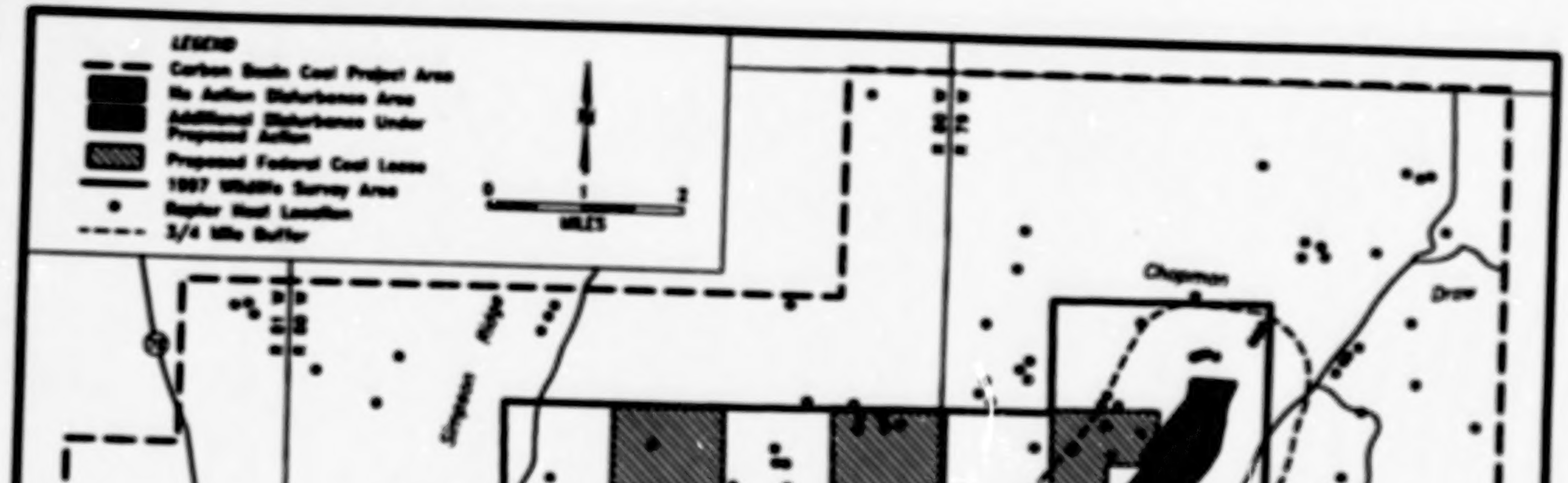
LEGEND
Carbon Basin Coal Project Area
No Action Disturbance Area
Additional Disturbance Under Proposed Action
Proposed Federal Coal Lease
1997 Wildlife Survey Area
Raptor Nest Location
3/4 Mile Buffer
0
1
2
MILES
N
Simpson Ridge
Chapman
Draw
T 21 N
T 20 N
T 21 N
T 20 N

Figure 3.11 Raptor Nest Locations Within 1997 Wildlife Survey Area (Long Dash Line). Short Dash Line Is 0.75-mi Buffer Around the No Action Disturbance Area Used in Impact Analysis.

Table 3.16 Number of Active and Inactive Raptor Nests Within the 1997 Raptor Survey Area.

Raptor Species	1997 Nest Status	Number of Nests
Ferruginous hawk	Active	4
	Inactive	79
Golden eagle	Active	4
	Inactive	22
Bald eagle	Active	1[1]
	Inactive	2
Red-tailed hawk	Active	10
	Inactive	25
Prairie falcon	Active	4
	Inactive	8
Swainson's hawk	Active	2
	Inactive	3
Great horned owl	Active	4
	Inactive	0
American kestrel	Active	1
	Inactive	0
Unknown species	Active	0
	Inactive	6
Total	Active	30
	Inactive	145

Source: Intermountain Resources 1997.

[1] Nest was located just outside the survey area boundary.

Table 3.17 1997 Productivity Data for 30 Active Nests in the Raptor Survey Area.

Species	Number of Active Nests	Total Number of Nests Producing Nestlings	Total Number of Nestlings	Number of Active Nests With Unknown Production[1]
Ferruginous hawk	4	2	5	0
Golden eagle	4	1	1	0
Bald eagle	1	1	1	0
Red-tailed hawk	10	6	12	4
Prairie falcon	4	2	7	2
Swainson's hawk	2	0	0	1
Great horned owl	4	4	6	--
American kestrel	1	0	0	1
Total	30	16	32	8

Source: Intermountain Resources 1997.

[1] Production was undetermined on several nests due to inaccessibility or visual obstruction.

Approximately 1,750 acres of the Hanna Raptor Concentration Area (RCA) occurs within the 1- to 2-mi buffer of the CBCPA (Figure 3.12); however, the RCA does not extend into the CBCPA. RCAs are characterized by cliffs or other geologic formations and contain high concentrations of nesting ferruginous hawks and/or golden eagles and prairie falcons (BLM 1987a).

Upland Game Birds. Two species of upland game birds--sage grouse and mourning dove--occur within the CBCPA. Although wild turkeys, sharp-tailed grouse, and blue grouse may infrequently pass through the CBCPA (Luce et al. 1997), these species are unlikely to remain in the area (personal communication, August 14, 1997, with Rich Guenzel, Wildlife Biologist, WGFD, Laramie), and they are not discussed further in this EIS.

Sage grouse habitat is characterized by an interspersed mixture of sagebrush and grassland. In winter, sage grouse use tall dense stands of sagebrush that remain relatively exposed through deep snow (Greer n.d.). Low sagebrush on windswept knolls is also used as feeding sites. During the spring, sage grouse gather on breeding grounds, or leks, characterized by open areas (e.g., meadows, low sagebrush zones) surrounded by denser sagebrush cover (Greer n.d.). Sage grouse return year after year to these leks, although their exact location may shift slightly between years. The area within 0.25 mi of a lek center is considered potential breeding habitat and is protected from surface disturbance through a BLM surface disturbance stipulation as described in the GDRA RMP (BLM 1987a). Sage grouse tend to nest within 2 mi of the lek center (BLM 1987a; Greer n.d.); this area is considered probable nesting habitat and is closed to surface-disturbing activity from February 1 to July 31.

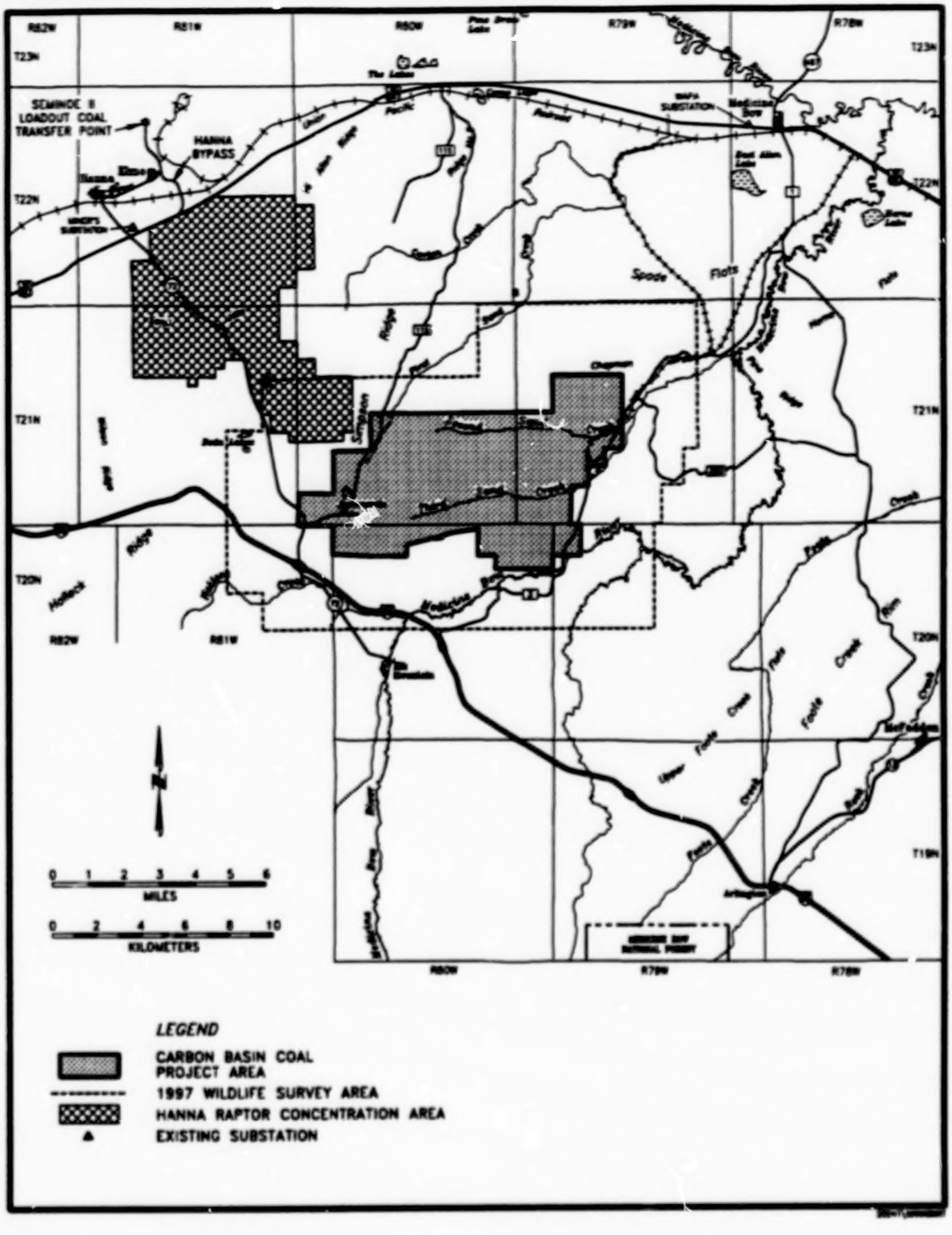

Figure 3.12 Raptor Concentration Areas Adjacent to the Carbon Basin Coal Project Area.

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The BLM stipulations within the abovementioned 0.25-mi and 2.0-mi buffers are based on numerous published scientific studies. Wallestad and Pyrah (1974) determined that 68% of sage grouse nests were within 1.5 mi of leks in central Montana. Braun et al. (1977) confirmed that the area within 2 mi of a lek often includes 60 to 80% of the nesting sage grouse from the lek. A large proportion of sage grouse nests (92%) may be protected from disturbance through application of a 2.0-mi buffer (Wakkinen et al. 1992). Sage grouse select sagebrush-grassland habitats with relatively tall sagebrush and canopy coverage ranging from approximately 10 to 40% in which to build nests (Wallestad and Pyrah 1974; Rothenmaier 1979).

Based on BLM (n.d.) and WGFD (1997) records and 1997 on-site aerial and ground surveys (Intermountain Resources 1997), six sage grouse leks are known to occur within the 1997 wildlife survey area (see Figures 3.6 and 3.13). Surveys in the spring of 1997 indicated that two of the known leks were active: one in the west-central CBCPA and the other just north of the CBCPA. A maximum of six and 12 males, respectively, were in attendance on these two leks. The most recent reported dates of activity for the remaining four leks are 1982, 1986, 1991, and 1994.

Based on the two active leks, approximately 500 acres within the CBCPA (3%) are sage grouse breeding habitat and 14,320 acres (28%) are nesting habitat. However, all leks, regardless of activity status, represent sites chosen by sage grouse for reproductive activity. Thus, based on all six known leks, approximately 500 acres within the CBCPA (3%) would be considered breeding habitat and 14,320 acres (78%) would be considered nesting habitat.

During winter, sage grouse are obligate to sage shrublands (personal communication, August 14, 1997, with Rich Guenzel, Wildlife Biologist, WGFD, Laramie). Excellent sage grouse wintering habitat (i.e., rolling topography with dense sage cover and perennial springs) occurs within the CBCPA, especially along and to the north of a low ridge in sec. 4-6, T.20 N., R.80 W., in the southern portion of the CBCPA (personal communication, August 26, 1997, with Pat Deibert, Habitat Protection Biologist, WGFD, Cheyenne). Although wintering areas may be used year after year, their use is likely shifted depending on seasonal conditions (e.g., topography, wind direction, snow deposition). No species-specific winter sage grouse surveys were conducted within the 1997 wildlife survey area (see Figure 3.6); however, several incidental observations of sage grouse were recorded during winter months (Intermountain Resources 1997).

The mourning dove is a common breeding bird in the CBCPA. Mourning dove concentrations are usually highest around power lines, buildings, and other areas of human disturbance, which occur on a relatively small portion of the CBCPA. Doves prefer the shrub-covered areas along perennial water sources and washes that provide nesting and roosting cover. The birds migrate from the area in the fall and winter.

Waterfowl, Shorebirds, and Waders. A number of waterfowl species have been observed on the various impoundments, reservoirs, and perennial creeks and rivers within and immediately adjacent to the CBCPA, including: snow and Canada geese; tundra swan; green-winged, blue-winged, and cinnamon teal; mallard; northern pintail; northern shoveler; gadwall; American wigeon; canvasback; redhead; ring-necked duck; lesser scaup; common goldeneye; and bufflehead (TRC Mariah 1995; Intermountain Resources 1997; WGFD 1997b). Waterfowl, as well as shorebirds and waders, use the CBCPA during migration (spring and fall), and some species (e.g., Canada goose, mallard) probably breed in the area during spring and summer (Dorn and Dorn 1990; Luce et al. 1997).

Water birds, shorebirds, and wading species observed on or adjacent to the CBCPA are those commonly found in similar habitats in southern Wyoming, including: common loon; pied-billed, eared, and western grebes; common merganser; American white pelican; double-crested cormorant;

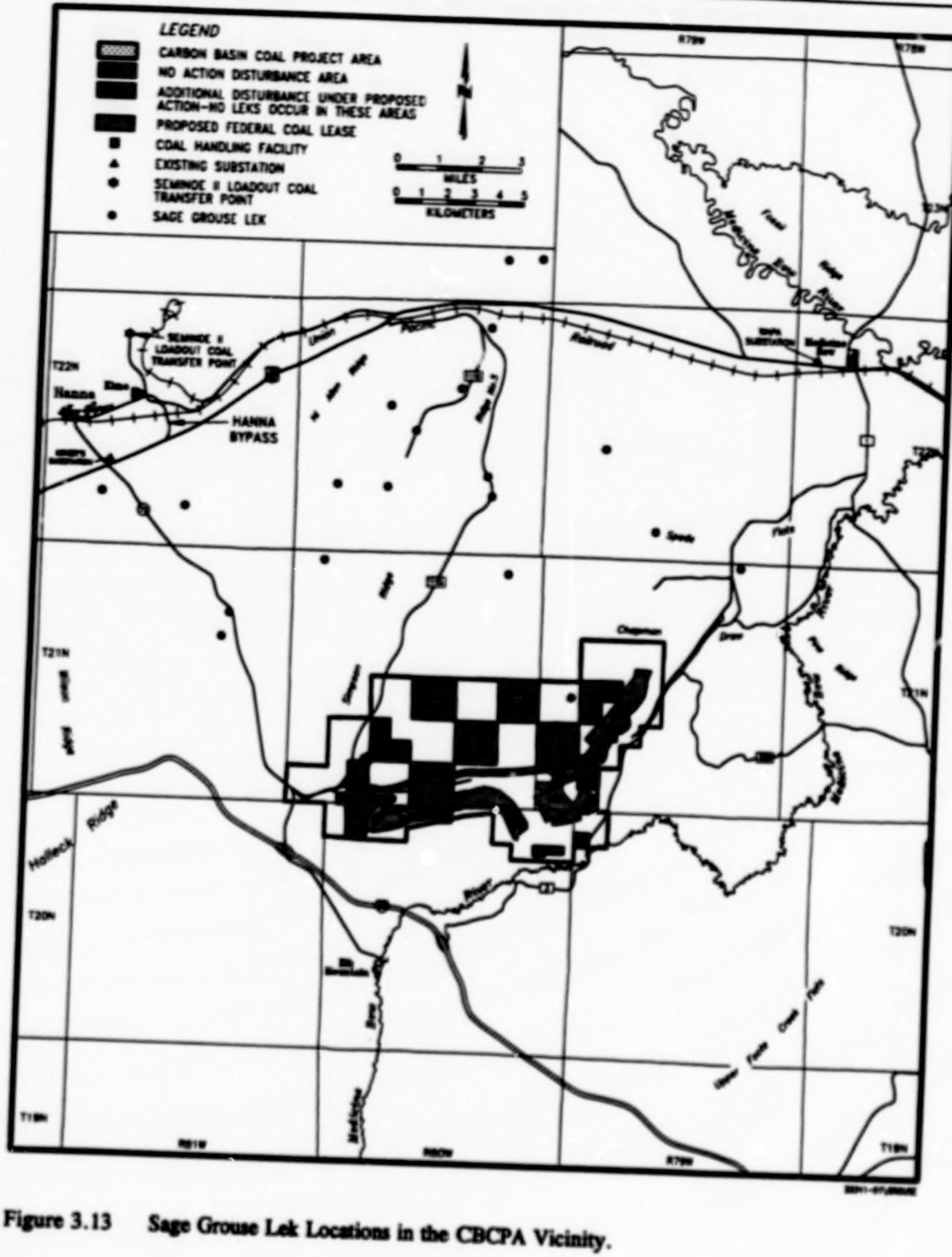
LEGEND
CARBON BASIN COAL PROJECT AREA
NO ACTION DISTURBANCE AREA
ADDITIONAL DISTURBANCE UNDER PROPOSED ACTION–NO LEKS OCCUR IN THESE AREAS
PROPOSED FEDERAL COAL LEASE
COAL HANDLING FACILITY
EXISTING SUBSTATION
SEMINOE II LOADOUT COAL TRANSFER POINT
SAGE GROUSE LEK
N
0 1 2 3
MILES
0 1 2 3 4 5
KILOMETERS
SEMINOE II LOADOUT COAL TRANSFER POINT
T22N
Hanna
HANNA BYPASS
Union Pacific Railroad
Spade
Chapman
Halleck Ridge
River
T21N
T20N
T19N
R81W
R80W
R79W
R78W

Figure 3.13 **Sage Grouse Lek Locations in the CBCPA Vicinity.**

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great blue heron; white-faced ibis; Virginia rail; sora; American coot; sandhill crane; killdeer; semipalmated and mountain plovers; American avocet; greater yellowlegs; spotted, upland, and Baird's sandpipers; long-billed curlew; long-billed dowitcher; common snipe; Wilson's phalarope; and Franklin's and California gulls (TRC Mariah 1995; Intermountain Resources 1997; WGFD 1997b). Some of these species are known to breed (e.g., northern pintail, American avocet, killdeer) or are likely to breed within the CBCPA (Dorn and Dorn 1990; TRC Mariah 1995). Based on range and habitat preference (Scott 1987; Luce et al. 1997), a number of other species of grebes, herons, egrets, mergansers, plovers, sandpipers, gulls, and terns may occasionally move through the CBCPA (Appendix A).

Passerines. Based on range and habitat preference, approximately 148 passerine species occur or potentially occur on or adjacent to the CBCPA (Appendix A). Many of these species occur primarily during spring and fall migration (Scott 1987; Luce et al. 1997). Common species in the vicinity include horned lark; cliff swallow; barn swallow; black-billed magpie; common raven; American crow; mountain bluebird; sage thrasher; green-tailed towhee; Brewer's, vesper, and lark sparrows; and western meadowlark (TRC Mariah 1995; Intermountain Resources 1997).

3.2.2.3 Amphibians and Reptiles

Based on range and habitat preference (Stebbins 1966; Baxter and Stone 1985), three amphibian and four reptile species are likely to occur within the CBCPA. Amphibian species include tiger salamander, chorus frog, and leopard frog. Amphibians on the CBCPA primarily occur in and adjacent to ephemeral, intermittent, and perennial water habitats (e.g., Medicine Bow River, Second and Third Sand Creeks, Sevenmile Lake). Reptile species potentially occurring on the CBCPA include northern sagebrush lizard, eastern short-horned lizard, prairie rattlesnake, and western terrestrial garter snake.

3.2.2.4 Fisheries

Oberholtzer (1985) provides a comprehensive survey of fish species within all of the major drainages in the CBCPA.

The Medicine Bow River is a WGFD Class 4 stream and WDEQ Class 2 surface water. WGFD Class 4 streams are considered low production trout waters that may be fisheries of local importance, but are generally incapable of sustaining substantial fishing pressure (WGFD 1991). The section of the Medicine Bow River within the CBCPA supports a variety of fish species, including brown trout, brook trout, rainbow trout, walleye, longnose dace, longnose sucker, white sucker, common carp, creek chub, silver shiner, and johnny darter. The remainder of the drainages within the CBCPA (e.g., Second and Third Sand Creeks) are intermittent/ephemeral streams that do not support any fish populations.

3.2.3 Threatened, Endangered, and Candidate Species and Species of Concern

To ensure compliance with the ESA (16 USC 1531 et seq.), which protects listed threatened, endangered, and candidate (TE&C) plant and animal species and their critical habitats, a Biological Assessment (BA) analyzing the effects of the proposed project on TE&C species is being prepared. In addition, surveys for TE&C species will be conducted, if necessary, on a case-by-case basis as directed by the U.S. Fish and Wildlife Service (USFWS) and BLM as components of the permitting process.

Five TE&C wildlife species have been documented or potentially occur on the CBCPA. Thirty-six additional USFWS and/or Wyoming state species of concern occur or potentially occur in the CBCPA. USFWS species of concern are former Category 2 candidate species, and Wyoming species of concern are specified as such by WGFD.

Migratory birds and their nests are protected from take or disturbance under the *Migratory Bird*

Treaty Act (16 USC 701-715), and USFWS has identified a list of migratory birds as species of management concern for Region 6 (USFWS 1995). A number of these species occur or potentially occur on or within 2 mi of the CBCPA.

In addition, all raptors are considered species of management concern by the BLM. TE&C raptors are addressed below. Other raptors are discussed on Section 3.2.2.2. Table 3.18 TE&C status species which have been documented or potentially occur within the CBCPA.

3.2.3.1 Wildlife

Threatened, Endangered, and Candidate Species.

The USFWS has indicated that three threatened or endangered (T&E) wildlife species, black-footed ferret, bald eagle, and peregrine falcon, may occur on or adjacent to the CBCPA (USFWS 1996, 1997). Two candidate species (formerly federally listed as Category 1 candidate species), mountain plover and swift fox, also occur or potentially occur in the CBCPA (see Table 3.18). In addition, a number of WGFD and/or USFWS species of concern and USFWS Region 6 migratory bird species of management concern occur on or adjacent to the CBCPA.

Black-footed ferret. The federally endangered black-footed ferret was once distributed throughout the high plains of the Rocky Mountain and western Great Plains regions (Forrest et al. 1985). Prairie dogs are the main food source of black-footed ferrets (Sheets et al. 1972), and few ferrets have been historically collected away from prairie dog colonies (Forrest et al. 1985). Black-footed ferrets were considered extinct until a small population was discovered near Meeteetse, Wyoming, in 1981. Following outbreaks of canine distemper, surviving ferrets were brought into captivity and a captive breeding program was initiated (USFWS 1988). Black-footed ferrets were reintroduced in the Shirley Basin region of central Wyoming in 1991. This reintroduction effort continues with the aid of annual supplemental releases.

Although it is very unlikely that black-footed ferrets are present on or near the CBCPA, white-tailed prairie dog colonies are scattered throughout the CBCPA and adjacent areas and could provide a potential prey base and suitable habitat for ferrets. Thirty prairie dog colonies were mapped within the wildlife survey area during 1997, 15 of which were wholly or partially within the CBCPA (Intermountain Resources 1997) (Figure 3.14). Total acreage of prairie dog colonies within the CBCPA is approximately 1,450 acres (i.e., 8% of the CBCPA). Estimated burrow densities in all 30 colonies exceed 8 burrows/acre; therefore, all 30 meet the USFWS density criteria for potential black-footed ferret habitat.

Approximately 31% (5,600 acres) of the CBCPA is classified as black-footed ferret Primary Management Zone 2 (PMZ2) (see Figure 3.14). PMZs are areas designated by the WGFD, BLM, and USFWS to assist in the management of the black-footed ferret reintroduction effort (WGFD and BLM 1991). PMZ1 (Shirley Basin) was established as the preferred release site in the management area, and PMZ2 (Medicine Bow) was designated as a secondary release site. Ferrets have been reintroduced into PMZ1 under an experimental/ nonessential designation, and movement outside of the PMZ is anticipated as the ferrets become established and disperse throughout the area. The area south and east of the North Platte River was declared ferret-free prior to the reintroduction of ferrets in Shirley Basin (WGFD and BLM 1991). The reintroduced ferrets appear to have moved to the very southern portions of PMZ1 and into PMZ2; thus, although the management guidelines presented in the 1991 black-footed ferret plan (WGFD and BLM 1991) did not require ferret searches to be conducted in PMZs due to the experimental/nonessential designation of the populations in those areas, the USFWS and WGFD currently recommend that ferret surveys be conducted in all PMZs (BLM 1997a).

Bald eagle. The bald eagle is a federally threatened species which requires cliffs, large trees, or sheltered canyons associated with

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Table 3.18 List of Threatened, Endangered, Candidate, and Species of Concern Documented or Potentially Occurring on or in the Vicinity of the CBCPA.[1]

Species		Status[2, 3]			Documented on or in Vicinity of the CBCPA[4]	Habitat Type(s)[5]
Common Name	Scientific Name	USFWS	BLM	WGFD		
BLM-Managed Species						
Black-footed ferret	*Mustela nigripes*	LE	X	X	Yes[6]	SS, GF, GS, DS
Peregrine falcon	*Falco peregrinus*	LE	X	X	Yes	UB
Bald eagle	*Haliaeetus leucocephalus*	LT	X	X	Yes[7]	UB
Mountain plover	*Charadrius montanus*	C, MC	X	X	Yes[7]	DS, GS
Swift fox	*Vulpes velox*	C	X	X	Yes[7]	GS, HM, DS
Northern goshawk	*Accipiter gentilis*	SC, MC	X	X	Yes[7]	FT
Ferruginous hawk	*Buteo regalis*	SC, MC	X	X	Yes[7]	UB
Western burrowing owl	*Athene cunicularia hypugaea*	SC, MC	X	--	Yes[7]	SS, GF, GS, DS, HM
Turkey vulture[8]	*Cathartes aura*	--	X	--	Yes[7]	UB
Osprey[8]	*Pandion haliaetus*	--	X	--	Yes[7]	CR
Northern harrier[8]	*Circus cyaneus*	MC	X	--	Yes[7]	UB
Sharp-shinned hawk[8]	*Accipiter striatus*	--	X	--	Yes[7]	UB, esp. CR
Cooper's hawk[8]	*Accipiter cooperii*	--	X	--	Yes[7]	UB, esp. CR
Broad-winged hawk[8]	*Buteo platypterus*	--	X	--	Yes	FT
Swainson's hawk[8]	*Buteo swainsoni*	--	X	--	Yes[7]	UB
Red-tailed hawk[8]	*Buteo jamaicensis*	--	X	--	Yes[7]	UB
Rough-legged hawk[8]	*Buteo lagopus*	--	X	--	Yes	UB
Golden eagle[8]	*Aquila chrysaetos*	--	X	--	Yes[7]	UB
American kestrel[8]	*Falco sparverius*	--	X	--	Yes[7]	UB

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Table 3.18 (Continued)

Species		Status[2,3]			Documented on or in Vicinity of the CBCPA[4]	Habitat Type(s)[5]
Common Name	Scientific Name	USFWS	BLM	WGFD		
Merlin[6]	*Falco columbarius*	–	X	X	Yes	UB
Prairie falcon[6]	*Falco mexicanus*	–	X	–	Yes[7]	[illegible]B
Barn owl[8]	*Tyto alba*	MC	X	–	Yes	UB
Great horned owl[8]	*Bubo virginianus*	–	X	–	Yes[7]	UB
Long-eared owl[8]	*Asio otus*	–	X	–	Yes	UB
Short-eared owl[8]	*Asio flammeus*	MC	X	–	Yes	UB
Additional USFWS Species of Concern						
Common loon	*Gavia immer*	MC	X	X	Yes	FT
White-faced ibis	*Plegadis chihi*	SC, MC	X	X	Yes	FT (CR)
Trumpeter swan	*Cygnus buccinator*	SC, MC	X	X	Yes	FT
Upland sandpiper	*Bartramia longicauda*	MC	–	–	Yes	FT (GS, HM)
Long-billed curlew	*Numenius americanus*	MC	X	X	Yes[7]	BS, GS
Black tern	*Chlidonias niger*	SC, MC	X	X	Yes[7]	FT (CR)
Gray flycatcher	*Empidonax wrightii*	MC	–	–	No	FT (SS)
Bewick's wren	*Thryomanes bewickii*	MC	–	–	Yes[7]	SS
Veery	*Catharus fuscescens*	MC	–	–	Yes[7]	CR
Loggerhead shrike	*Lanius ludovicianus*	SC, MC	–	–	Yes[7]	UB
Virginia's warbler	*Vermivora virginiae*	MC	–	–	Yes	FT
Dickcissel	*Spiza americana*	MC	–	–	Yes	FT
Brewer's sparrow	*Spizella breweri*	MC	–	–	Yes[7]	SS

Table 3.18 (Continued)

Species		Status[2, 3]			Documented on or in Vicinity of the CBCPA[4]	Habitat Type(s)[5]
Common Name	Scientific Name	USFWS	BLM	WGFD		
Lark bunting	*Calamospiza melanocorys*	MC	–	–	Yes[7]	SS, GF, GS, HM
Baird's sparrow	*Ammouramus bairdii*	SC, MC	–	–	No	FT (GS, HM)
McCown's longspur	*Calcarius mccownii*	MC	–	–	Yes[7]	SS, GF, GS, HM
Chestnut-collared longspur	*Calcarius ornatus*	MC	–	–	Yes	FT
Western small-footed myotis	*Myotis ciliolabrum*	SC	X	X	No	FT (UB)
Long-legged myotis	*Myotis volans*	SC	X	X	Yes[6]	FT (UB)
Townsend's big-eared bat	*Plecotus townsendii*	SC	X	X	No	FT (SS, GS)
Additional Wyoming Game and Fish Department Species of Concern						
American white pelican	*Pelecanus erythrorhynchos*	–	X	X	Yes	FT (P/R)
Snowy egret	*Egretta thula*	–	X	X	Yes[7]	FT (CR, P/R)
Black-crowned night heron	*Nycticorax nycticorax*	–	X	X	Yes[7]	FT (CR)
Tundra swan	*Cygnus columbianus*	–	–	X	Yes	FT
Caspian tern	*Sterna caspia*	–	X	X	Yes	FT (CR, P/R)
Forster's tern	*Sterna forsteri*	–	X	X	Yes[7]	FT (CR, P/R)
Lewis' woodpecker	*Melanerpes lewis*	–	X	X	Yes[7]	CR
Ash-throated flycatcher	*Myiarchus cinerascens*	–	X	X	Yes	FT
Scrub jay	*Aphelocoma coerulescens*	–	X	X	Yes	FT
Plain titmouse	*Parus inornatus*	–	X	X	Yes	FT (CR)
Bushtit	*Psaltriparus minimus*	–	X	X	Yes	FT (CR)
Little brown myotis	*Myotis lucifugus*	–	X	X	Yes[7]	FT (UB)

Table 3.18 (Continued)

Species		Status[2,3]			Documented on or in Vicinity of the CBCPA[4]	Habitat Type(s)[5]
Common Name	Scientific Name	USFWS	BLM	WGFD		
Big brown bat	*Eptesicus fuscus*	–	X	X	Yes	FT (UB)
Pallid bat	*Antrozous pallidus*	–	X	X	No	FT (UB)

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[1] Wyoming Natural Diversity Database (WYNDD) (1997) search; U.S. Fish and Wildlife Service (USFWS) (1996, 1997) consultation; Wyoming Game and Fish Department (WGFD) (1997b) list of species of concern; and Fertig (1997).

[2] USFWS = U.S. Fish and Wildlife Service, WGFD = Wyoming Game and Fish Department, BLM = Bureau of Land Management.

[3] LE = USFWS listed endangered; LT = USFWS listed threatened; C = USFWS candidate species; SC = USFWS species of concern; MC = USFWS migratory bird species of management concern, Region 6 (USFWS 1995); X = given special status by the agency listed (i.e., WGFD, USFWS, and/or BLM).

[4] Indicates documentation of bird species within latitude 41°, longitude 106° (Dorn and Dorn 1990; WGFD 1992), or documentation of mammal species within latitude 41°, longitude 106° (Luce et al. 1997).

[5] SS = sagebrush/shrubland; GF = greasewood flats; GS = grassland/grass-subshrub; HM = hay meadow; DS = disturbed; P/R = pond/reservoir; CR = cottonwood/riparian; UB = ubiquitous; and FT = fly through.

[6] Species has been documented breeding within latitude 41°, longitude 106° (Dorn and Dorn 1990; Luce et al. 1997).

[7] Documentation of historical observation only (Luce et al. 1997).

[8] All raptors are given special status by BLM.

[9] Documented in the vicinity of the CBCPA by Mariah (1995).

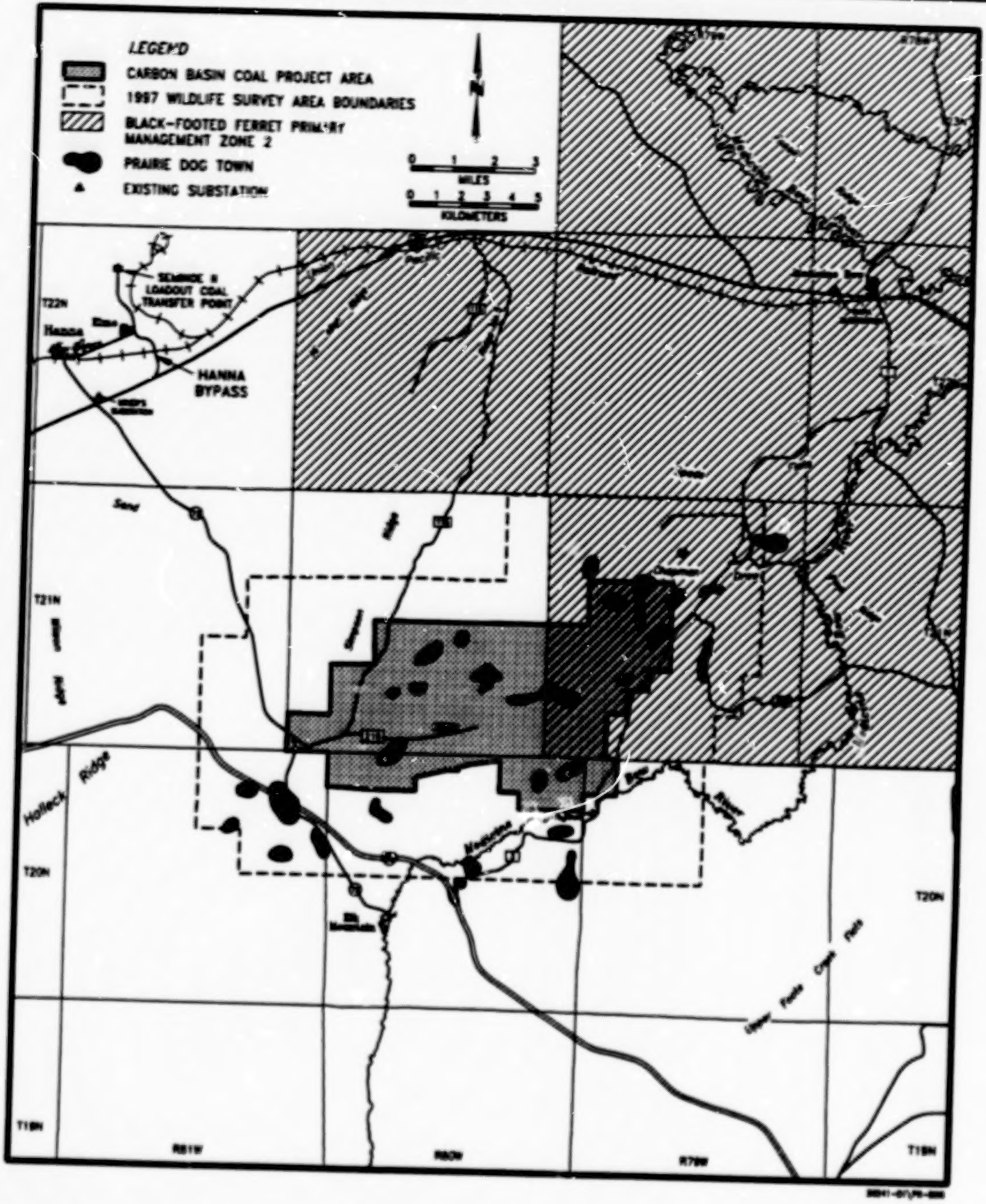
LEGEND
CARBON BASIN COAL PROJECT AREA
1997 WILDLIFE SURVEY AREA BOUNDARIES
BLACK-FOOTED FERRET PRIMARY MANAGEMENT ZONE 2
PRAIRIE DOG TOWN
EXISTING SUBSTATION
N
0 1 2 3
MILES
0 1 2 3 4 5
KILOMETERS
SEMINOE II LOADOUT COAL TRANSFER POINT
T22N
Hanna
HANNA BYPASS
Sand
T21N
Halleck Ridge
T20N
T19N
R81W
R80W
R79W
T20N
T19N

Figure 3.14 **Prairie Dog Colonies and Black-footed Ferret Primary Management Zones Within the 1997 Wildlife Survey Area, Carbon Basin Coal Project, Carbon County, Wyoming.**

concentrated food sources (e.g., fisheries or waterfowl concentration areas) for nesting and/or roosting areas (Edwards 1969; Snow 1973; Call 1978; Steenhof 1978; Peterson 1986). Bald eagles forage widely during the nonnesting season (i.e., fall and winter) and scavenge on animal carcasses such as deer and elk.

During 1994, one bald eagle nest was documented approximately 2.3 mi west-southwest of the CBCPA (TRC Mariah 1995). The nest was active in 1994, 1995, and 1997, fledging one juvenile each year (TRC Mariah 1995; Intermountain Resources 1997; Johnson et al. 1997; personal communication, August 11, 1997, with Dave Young, Jr., Wildlife Biologist, WEST). The status and productivity of the nest in 1996 is unknown, but adult birds were observed near the nest in the spring of 1996, indicating that it was likely active that year as well. This nest is just outside the 1997 raptor nest survey area for the Carbon Basin Mine project. A second bald eagle/red-tailed hawk nest is located just east of the abovementioned nest and within the 1997 raptor nest survey area. This nest was used by red-tailed hawks in 1997 (Intermountain Resources 1997). A third bald eagle nest, also inactive in 1997, is located along the Medicine Bow River within the 1997 raptor survey area and south of the CBCPA (Intermountain Resources 1997). A fourth bald eagle nest approximately 4.0 mi east-southeast of the CBCPA (i.e., outside the 1997 raptor survey area) was located in 1995 during surveys for the then proposed KENETECH Wind Plant. This nest was active in 1995 and was active, but failed, in 1997. Status in 1996 is unknown (Johnson et al. 1997; personal communication, August 11, 1997, with Dave Young, Jr., Wildlife Biologist, WEST).

Bald eagles apparently did not nest within the CBCPA during 1997; however, they did nest successfully just outside the adjacent 2-mi buffer, and it is likely that they use the CBCPA for foraging throughout the year. No communal winter bald eagle roosts are known to occur within the CBCPA, but it is likely that cottonwood trees along the Medicine Bow River are regularly used as perches in the winter, and wintering bald eagles are known to feed on road-killed deer in the area (BLM 1995a).

Peregrine falcon. The peregrine falcon, a federally endangered species, nests on tall cliffs, usually within 1.0 mi of a stream, river, or extensive brush or woodlands. These habitats provide concentrated food sources and open areas to hunt (Call 1978; Snow 1972). Peregrine falcons nest on substantial rock outcrops (usually southern exposure) in small caves or on overhanging ledges large enough to accommodate three to four full-grown nestlings (Wilderness Research Institute 1979). They feed almost exclusively on birds, many of which are associated with riparian zones and large bodies of water (i.e., waterfowl). No known peregrine falcon nests are located within the 1997 raptor survey area, and the CBCPA and surrounding lands lack the tall cliffs generally associated with suitable peregrine falcon nesting habitat.

Several peregrine falcons were observed during the spring migration season during 1997 wildlife surveys conducted for the Carbon Basin Mine project (Intermountain Resources 1997), and individuals were reported hunting in and flying through the Simpson Ridge and Foote Creek Rim areas adjacent to the CBCPA during 1994-1996 surveys conducted for the SeaWest (formerly KENETECH) Wind Plant (BLM 1995b; Johnson et al. 1997; Thomas et al. 1997). The Medicine Bow River and several ponds on the CBCPA (e.g., Sevenmile Lake, Fiddler's Green Reservoir) provide a source of potential waterfowl and shorebird prey. It is likely that wintering or migrating peregrine falcons also use the CBCPA on occasion.

Mountain plover. The mountain plover is a federal candidate species inhabiting the high dry shortgrass plains east of the Rocky Mountains (Dinsmore 1983). The locus of breeding activity appears to be southeastern Wyoming and eastern Colorado (Graul and Webster 1976). Graul and Webster (1976) noted that mountain plover nesting habitat is associated with blue grama and buffalo

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grass, although any short grass, very short shrub (e.g., Gardner saltbrush), or cushion plant type could be considered nesting habitat. Breeding bird surveys between 1966 and 1987 show an overall decline in the continental population of mountain plovers (U.S. Forest Service [USFS] 1994a). Surveys completed in 1991 indicate that only 4,360 to 5,610 mountain plovers remain on the North American continent (USFS 1994b). Loss of breeding habitat due to cultivation and prey-base declines resulting from pesticide use are major threats to mountain plover survival (Wiens and Dyer 1975).

Vegetation on the CBCPA is primarily sagebrush shrubland and mixed shrub/rough breaks (see Table 3.13) (i.e., unsuitable mountain plover habitat); however, scattered patches of suitable habitat (i.e., shortgrass prairie) exist in the CBCPA. During 1997 spring and summer surveys, several mountain plover observations were recorded within the CBCPA and adjacent 1- to 2-mi buffer. Although no formal nesting surveys were conducted and no nests or chicks were observed, an estimated six breeding pairs were recorded using the north-central portion of the CBCPA (personal communication, August 21, 1997, with Jim Orpet, Biologist, Intermountain Resources; Intermountain Resources 1997). Individuals were also observed using the northwestern portion of the wildlife study area (i.e., outside, but within 2.0 mi of the CBCPA) during the spring, but breeding activity was not confirmed in this area (Intermountain Resources 1997). Mountain plovers are known to breed successfully on Foote Creek Rim, approximately 7.5 mi southeast of the CBCPA (BLM 1995a; Johnson et al. 1997; Thomas et al. 1997; personal communication, August 11, 1997, with Dave Young, Wildlife Biologist, WEST).

Swift fox. The swift fox, a USFWS candidate species, is a resident of the northern Great Plains, from the Rocky Mountain foothills to Texas (Clark and Stromberg 1987). In Wyoming, this species inhabits the eastern Great Plains grasslands, occasionally utilizing agricultural lands and irrigated native meadows. Prey items include small mammals, insects, and birds (Luce et al. 1997).

No recent sightings of swift fox have been reported within the CBCPA (WYNDD 1997; personal communication, August 21, 1997, with Jim Orpet, Biologist, Intermountain Resources); however, a single observation of a swift fox was reported approximately 4 mi southeast of the CBCPA in 1991 (WGFD 1997b): the fox was reported as a mortality. The CBCPA contains scattered pockets of potential swift fox habitat (i.e., grassland, roadsides), and individuals may, at least infrequently, use the CBCPA and adjacent areas.

USFWS/WGFD Species of Concern.

Based on habitat preference and range, six WGFD bat species of concern (little brown myotis, western small-footed myotis, long-legged myotis, pallid bat, Townsend's big-eared bat, and big brown bat) occur or potentially occur in the vicinity of the CBCPA (Clark and Stromberg 1987; personal communication, August 19, 1997, with Bob Luce, Nongame Biologist, WGFD, Lander); however, only the little brown myotis, long-legged myotis, and the big brown bat have been recorded in the general vicinity (Luce et al. 1997). Several historical observations of the long-legged myotis are also documented in the vicinity, but no recent observations have been recorded, and it is unlikely that this bat species frequents the CBCPA.

The pallid bat generally inhabits low desert shrublands and grasslands, occasionally frequenting cottonwood/riparian areas as well (Oakleaf et al. 1996). It roosts primarily in buildings and rock crevices, but may also inhabit caves and abandoned mines (Priday and Luce 1995). The remaining abovementioned bat species inhabit caves and abandoned mines, which are the primary limiting factor to these species (Oakleaf et al. 1996). Portions of the CBCPA have been mined, both in historic and recent times, and it is possible that suitable bat habitat exists in the area if extant adits or other underground openings are present on the CBCPA. However, on-site archaeological and biological surveys of the area and AML records indicate that the likelihood for such habitat is limited (personal communication, August 21, 1997, with Jim Orpet, Biologist, Intermountain Resources; personal communication, August 19, 1997, with Barry Shelly, Project Manager, AML).

Forty-two USFWS and/or WGFD bird species of concern are known to occur or may occur on the CBCPA (see Table 3.18). Ten of these species (i.e., common loon, American white pelican, white-faced ibis, tundra swan, trumpeter swan, Caspian tern, ash-throated flycatcher, scrub jay, plain titmouse, and bushtit) have been observed, but are not known to breed in the vicinity of the CBCPA (Luce et al. 1997). The snowy egret, black-crowned night heron, Forster's and black terns, northern goshawk, and Lewis' woodpecker may breed in the vicinity (Luce et al. 1997). The riparian and/or wooded habitats preferred by the abovementioned species are limited primarily to the Medicine Bow River corridor southeast of the CBCPA.

The ferruginous hawk, loggerhead shrike, merlin, western burrowing owl, and long-billed curlew likely breed and/or forage regularly in the vicinity of the CBCPA (e.g., Intermountain Resources 1997; Luce et al. 1997; Thomas et al. 1997). Ferruginous hawks are summer residents, breeding in semiarid plains and intermountain areas throughout the Great Basin and Great Plains (Evans 1983) and often nesting on low cliffs, buttes, and cutbanks (Call 1978). They feed primarily on small- to medium-sized mammals such as jackrabbits, cottontail rabbits, ground squirrels and prairie dogs (Sherrod 1978).

Four active and 79 inactive ferruginous hawk nests representing approximately 35 territories were located within the 1997 Carbon Basin Mine raptor survey area (see Figure 3.6). Approximately 46 of the inactive nests and three of the active nests were located within the CBCPA (Intermountain Resources 1997). One of the three active nests within the CBCPA produced three fledglings in 1997; the other active nest within the 1997 survey area that was successful produced two fledglings (see Table 3.17).

In Wyoming, the loggerhead shrike, a federal species of concern, inhabits sagebrush-grasslands associated with stands of pinyon-juniper and larger shrubs (Luce et al. 1997). These habitats provide ample open areas in which to forage for insects and small vertebrates (Craig 1978; Bystrak 1983), as well as trees and shrubs in which to build their large, bulky nests (Graber et al. 1973). Although loggerhead shrike nests have not been observed on the CBCPA, it is likely that nesting does occur along the sagebrush draws and riparian areas located within the project area. Most of the CBCPA provides habitat conducive to shrike foraging and hunting activities.

Merlins are small falcons that often nest in mature cottonwood riparian zones (e.g., the Medicine Bow River corridor); however, there are no records of breeding merlins in the vicinity of the project area (Dorn and Dorn 1990; Luce et al. 1997). Three observations of merlins were recorded within the CBCPA during winter of 1995 (TRC Mariah 1995), and Johnson et al. (1997) reported observations of merlins in the Foote Creek Rim area approximately 8.0 mi east-southeast of the CBCPA during the spring. Use of the CBCPA is probably limited primarily to fall through early spring (Dorn and Dorn 1990).

The western burrowing owl is a small long-legged owl of the shortgrass prairie which nests in unoccupied mammal burrows, especially those of white-tailed prairie dogs (Dorn and Dorn 1990; Luce et al. 1997). Although suitable nesting habitat (including numerous prairie dog colonies) exists within the CBCPA (see Figure 3.14) and burrowing owls have occasionally been observed in the vicinity of the CBCPA (WGFD 1994), no individuals were observed during 1997 Carbon Basin Mine wildlife surveys (Intermountain Resources 1997). It is possible that this species nests and forages within the CBCPA; however, the paucity of recorded observations for the vicinity of

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the CBCPA indicates that burrowing owls are probably uncommon in the area.

The long-billed curlew, a Wyoming species of concern, breeds in arid grasslands and sagebrush/grasslands of the western Great Plains and Great Basin (Howe 1983). The birds arrive in the central Rocky Mountains in April (Behle and Perry 1975) and build shallow scrape nests in open areas of shortgrass prairie (Allen 1980). In addition to observations recorded during 1997 Carbon Basin Mine surveys, long-billed curlews have been reported on three additional occasions in the vicinity of the CBCPA. One individual was observed about 0.5 mi south of the CBCPA in 1983. The other two observations occurred in 1985 and 1987 approximately 2.5-3.5 mi south of the CBCPA (WGFD 1994). It is likely that curlews occasionally use wetland areas within the CBCPA for foraging or as stopover areas during migration, but probably remain in the area for only short periods of time. Long-billed curlew nesting activity has never been documented for the CBCPA, although appropriate nesting habitat is present over much of the area.

Baird's sparrow is a common summer resident of the upper Great Plains (Scott 1987). It is rare in Wyoming, where it is most likely to be found along the eastern edge of the state. Baird's sparrows prefer mid- and tall grass prairie and hay meadows (Dorn and Dorn 1990; Luce et al. 1997). While this species has not been observed within the CBCPA, it does occur in the shortgrass prairies of eastern Wyoming; therefore, it should be considered an unlikely summer visitor to the CBCPA. Any Baird's sparrows observed within the CBCPA would likely be vagrant individuals temporarily feeding or passing through the area.

An additional 10 species (i.e., not previously addressed above) have been identified as USFWS migratory birds of management concern (USFWS 1995) which occur or potentially occur within the CBCPA (see Table 3.18). Five (upland sandpiper, gray flycatcher, Virginia's warbler, dickcissel, and chestnut-collared longspur) are probably infrequent visitors to the area, and five (Bewick's wren, veery, Brewer's sparrow, lark bunting, and McCown's longspur) are known to breed in the vicinity of the CBCPA (Dorn and Dorn 1990; TRC Mariah 1995; Luce et al. 1997).

No other mammal, reptile, amphibian, or fish species of concern occurs or potentially occurs within the CBCPA.

3.2.3.2 Plants

In 1997, the Botany Department of the UW completed an inventory for the Ute ladies' tresses within the CBCPA; none were observed (Roderick 1998). One location within the CBCPA (the spring located in SW sec. 20, T.21 N., R.70 W.) is potential habitat for Ute ladies' tresses, as is the floodplain of the Medicine Bow River adjacent to the CBCPA. Ute ladies' tresses can exist underground before emerging, so future surveys of the spring area are warranted. The remainder of the CBCPA is generally too dry to be suitable habitat.

3.2.4 Wild Horses

Wild horses do not occur nor are they known to have occurred historically in the vicinity of the CBCPA (personal communication, August 20, 1997, with Chuck Reed, Wild Horse Specialist, BLM, GDRA); thus, they are not discussed further in this EIS.

3.3 CULTURAL RESOURCES

Cultural resources, which are protected under the *National Historic Preservation Act of 1966* (NHPA) and the *Archaeological Resources Protection Act of 1979* (ARPA), are nonrenewable remains of past human activity. The archaeological record of the CBCPA, except for sec. 21-24, T.21 N., R.80 W., and sec. 19, T.21 N., R.79 W., has been examined through State Historic Preservation Office (SHPO) file search data, field inventories, limited test excavations, and historic documents pertaining to the settlement and use of the area by Euro-Americans. The five unsurveyed sections would be field-inventoried if

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they are included in one of the mine permit applications.

A total of 160 sites has been recorded within the CBCPA (excluding the five unsurveyed sections); 114 sites are prehistoric, 37 are historic, and nine are multicomponent--containing both prehistoric and historic resources. Of these, 127 were newly identified during the 1997 Class III cultural resource inventory of the project area, and 33 were originally found during previous inventories. The sites are discussed in greater detail in Sections 3.3.1-3.3.3.

3.3.1 Prehistoric Resources

The Northwestern Plains have been inhabited by aboriginal hunting and gathering groups for over 11,000 years. Throughout the prehistoric past, the area was used by highly mobile hunters and gatherers who exploited a wide variety of resources. A chronological framework pertinent to the project area has been established for the Northwestern Plains, based mostly on artifact typology--projectile points in particular. Period names are based on Frison's (1978) modification of Mulloy's (1958) framework for Northwestern Plains prehistory. These periods include the Paleoindian; the Early, Middle, and Late Archaic; and the Late Prehistoric.

Prehistoric sites recorded within the permit area include open campsites, lithic scatters, stone circles, rockshelters, and cairns. Some of these sites include fire hearths, buried cultural layers in cutbanks, and/or bone of various mammals. Diagnostic projectile points representing types from the Early Archaic through the Late Prehistoric period have been identified on the sites. Thirty-two of the sites are potentially eligible for inclusion on the National Register of Historic Places (NRHP), and the remaining 82 sites are recommended as not eligible. The cultural resources defined as potentially eligible generally appear to have--or are highly likely to have--preserved buried cultural remains which, upon further investigation, could provide additional important data needed to address a variety of prehistoric research topics. Formal testing of these sites to reveal the nature and intactness of the cultural deposits is necessary to provide a definitive determination of NRHP eligibility.

A total of 17 prehistoric isolated finds was recorded during the 1997 inventory. These include six projectile points, three bifaces, three utilized flakes, two scrapers, two unmodified flakes, and one mano. None of these artifacts are recommended as eligible for the NRHP.

3.3.2 Historic Resources

According to Massey's (1989) chronological framework for Wyoming history, historical land use of the project area extends with certainty back to the Pre-territorial Period (1842-1868), and continues forward through the Modern Period (1939-Present). In addition, historic land use of the region by Native American groups including the Lakota Sioux (especially the Oglala), the Northern Arapaho, Northern Cheyenne, Eastern Shoshone, and Ute has been documented (Bryan 1857; Garbarino 1976). Historic contexts pertinent or potentially pertinent to the CBCPA include transportation and communication, coal mining, and ranching (cattle and sheep).

The historic Overland Trail passes just to the south of the CBCPA. Regular use of this trail began in July 1862. It was utilized as a mail, passenger, and freight road by the Overland Stage Company, linking Denver and Salt Lake City. In response to Native American attacks on stage and freight traffic along the Overland Trail, Fort Halleck was established in July 1862, at the northern base of Elk Mountain, west of the present-day town of Elk Mountain. It was abandoned in July 1866. Following the discovery of coal at Carbon and the construction of the Union Pacific Railroad, travel to the new railhead and mines at Carbon through the western portion of the project area was conducted on a road named the "Fort Halleck Road" in SHPO file search data, but known to long-time residents of the area only as the "Old Carbon Road" (Welch 1985). This wagon road probably extended from the Overland Trail in the vicinity of Fort Halleck or Medicine Bow Station (Elk Mountain) to the town of Carbon, approximately 5 mi north of the permit area. The road appears to have been used only after the abandonment of Fort Halleck and the establishment of Carbon and is therefore more appropriately named the "Old Carbon Road" than the "Fort Halleck Road."

Carbon, the earliest coal mining town in Wyoming Territory, was established in 1868 when the Wyoming Coal and Mining Company signed a contract to lease Union Pacific coal lands and provide the railroad with coal; the lease was terminated in 1874 and the Union Pacific took over production at the mines. The town of Carbon is outside of the CBCPA and all of the transportation corridors. The original route of the transcontinental railroad passed through Carbon, whose seven mines supplied coal to fuel the locomotives up to 1902 (Union Pacific Coal Company 1940; Gardner and Flores 1989). Five historic coal mines/camps, which operated primarily during the early 1900s, occur within the CBCPA. These include the Peterson/Terteling Camp, the Johnson Mine, the Kent Mine, the Black Diamond Mines, and the Richardson Mine. These mines were generally small operations that supplied coal to local ranches and the towns of Elk Mountain and Medicine Bow. Some coal was also trucked to Laramie.

Historic ranches and homesteads within or near the project area were established along the Medicine Bow River and in the vicinity of Sevenmile Lake. The oldest and largest ranch in the area is the Johnson Ranch, established in the 1880s along the Medicine Bow River just south of the permit area. The Johnson Mine (see Figure 3.3), which produced coal for the ranch (Seiersen 1981; Gardner et al. 1985), occurs within the CBCPA. The remains of Johnson winter ranch headquarters are located approximately 3.0 mi north of the main ranch and within the CBCPA (Seiersen 1981). The site is abandoned, but the original bunkhouse and a later addition remain standing. The addition to the original bunkhouse predates 1937.

The Fisher Homestead was discovered near the shore of Sevenmile Lake during the current survey of the CBCPA. This historic homestead is located on the west side of Sevenmile Lake, east of Simpson Ridge. The Old Carbon Road passes north/south between the homestead and the lake. James Fisher received a homestead entry patent for the land in 1906. Several foundations (including an original dugout habitation), scattered debris, and a developed spring remain at the site.

A second homestead was found 1.3 mi northeast of Sevenmile Lake. A prehistoric component is present at this site as well. It is further described in Section 3.3.3 below.

Additional historic resources occurring within the CBCPA include trash scatters, cairns (probably built by sheepherders), hunting blinds, and a cabin.

Sites recommended as eligible for nomination to the NRHP include the Johnson, Kent, Black Diamond, and Richardson Mines and the Johnson winter ranch headquarters. The remaining 32 historic sites are recommended as not eligible.

3.3.3 Multicomponent Sites

The multicomponent sites consist of five prehistoric camps with associated historic trash scatters, one homestead with an adjacent buried prehistoric cultural component(s) exposed in a cutbank, one prehistoric camp with a historic corral and debris, one stone circle and two adjacent historic bone caches, and a rockshelter with prehistoric material and historic inscriptions.

The homestead contains several collapsed structures, a developed spring, a rock pile, and scattered trash. David Edgar West received a stock-raising homestead patent for the property in 1937. The historic corral appears to be associated with activities related to the Johnson winter ranch headquarters.

Four of the prehistoric components of these sites are recommended as potentially eligible for inclusion on the NRHP. The remainder of the components (including five prehistoric and all nine historic components) are not considered eligible for the NRHP.

3.3.4 Traditional Cultural Properties

The BLM has consulted with Native American tribes that may have sites or Traditional Cultural Properties (TCPs) of religious or cultural importance in the area. Properties usually of greatest concern to Native Americans are burials and certain types of rock features. According to Gary DeMarcay, BLM Rawlins, the CBCPA is of concern to certain tribes because of its proximity to Foote Creek Rim (approximately 10 mi to the east) where numerous stone alignments of importance to Native Americans have been identified (Schneider et al. 1995). No cultural resources that would appear to qualify as significant TCPs were recorded in the CBCPA, because no burials were located and the only rock features consisted of cairns of questionable temporal affiliation and sporadically occurring stone circles (tipi rings). The BLM will request further comments from interested Native American groups on the cultural resources identified within the CBCPA.

3.4 SOCIOECONOMICS

The geographic area considered for socioeconomic analysis encompasses portions of central Carbon County including the communities of Elk Mountain, Hanna, McFadden, Medicine Bow, Rawlins, Saratoga, and Sinclair. These communities were selected because they are in close proximity to the proposed project and because they provide housing and services to existing mine personnel and would likely do so for mine personnel employed at the proposed project.

3.4.1 Employment

Seventy percent of the average annual covered employment (those employees covered by the Unemployment Insurance Law) in Carbon County in 1996 were in the private sector and 30% in the public sector (Wyoming Department of Employment [WDOE] 1997). Average annual employment has decreased by 1.8% over the 7-year period from 1989 to 1996. The total payroll for the private sector was approximately $92 million, or 67% of the $137 million payroll in Carbon County during 1996. Total wages have increased by 17% since 1989; however, total wages decreased 2.7% in 1996 as compared to 1995. Of the 4,474 private sector jobs, 1,352 (30%) were in retail trade, 1,157 (26%) were in services, 561 (13%) were in manufacturing, and 350 (8%) were in mining (which includes oil and gas). Sixty-five percent of the 1,922 government employees worked for local governments, 25% for state government, and 10% for the federal government.

The average annual wage for Carbon County employees in 1996 was $21,412 (WDOE 1997). The mining industry (which includes oil and gas) had the highest average annual wage ($47,089), followed by federal employees ($34,624) and manufacturing ($34,443). The lowest average annual wages were for retail trade ($11,188) and services ($14,780). Average annual wages in Carbon County have increased 18% since 1989.

Major private sector employers in Carbon County include coal mines, oil and gas production companies, and Memorial Hospital in Rawlins, whereas major public sector employers include the Wyoming State Penitentiary, School Districts 1 and 2, and the City of Rawlins (Wyoming Department of Administration and Information [WDAI] 1996; Stubbs 1997). Unemployment rates in Carbon County during 1997 (through September) varied from a high of 7% in January to 2.6% in September, when unemployment rates were 5.8% and 3.5%, respectively, in Wyoming (Bullard 1997; Wyoming Employment Resources Division 1997).

The Cyprus-Shoshone underground mine annually contributes about 128 full-time jobs and $12.3 million in direct expenditures to the Carbon County economy--about $8.1 million in employee salaries and wages and $4.2 million in local expenditures for materials, supplies, and services needed to support mine operations (Pedersen Planning Consultants [Pedersen] 1997). Application of an input-output model by the UW (1996) suggests that the mine generated another $2.9 million in indirect expenditures that generated about 168 jobs in the service sector of the county's economy. Cyprus-Shoshone employees earn an annual wage of about $58,000.

Arch operates the only two active surface mines in Carbon County–Seminoe II and Medicine Bow. The two mines provided employment for about 97 full-time employees and generated about $5 million in wages, salaries, and related employee benefits (Pedersen 1997). Other purchases by Arch in the Carbon County economy represented an additional $2.09 million in 1995. In total, Arch contributed about $7.09 million to the Carbon County economy in 1996. The regional input-output model (UW 1996) estimated that surface mining created about 82 additional jobs not directly associated with the mine, and these jobs generated about $1.42 million to Carbon County residents. Arch employees earn an average annual wage of about $53,000.

3.4.2 Population

Carbon County's 1990 population was 16,659 (WDAI 1996). The 1996 estimated population is 15,855 (Liu 1997). Estimated 1996 populations for communities most likely affected by the proposed project are: Rawlins, 9,178; Saratoga, 1,885; Hanna, 1,054; Elk Mountain, 188; and Medicine Bow, 369 (Liu 1997). The approximately 225 full-time employees at the existing coal mines in the Hanna area reside primarily in Hanna/Elmo (126 employees [56%]), Saratoga/Encampment (36 employees [16%]), and Rawlins/Sinclair (20 employees [11%]). Smaller numbers live in Medicine Bow, Elk Mountain, and communities outside of Carbon County.

3.4.3 Housing

There are about 6,379 residential units in incorporated areas in the vicinity of the CBCPA, and approximately 5,051 (79%) of these are occupied (Pedersen 1997). Additional units occur in unincorporated areas, and these have a much lower occupancy rate. Numerous hotel and motel facilities are available, especially in Rawlins and Saratoga.

3.4.4 Schools

Carbon County has two school districts. District No. 2 includes the project area, serving eastern Carbon County, and would be most affected by the existing mines. This district includes schools in Medicine Bow, Encampment, Hanna, Elk Mountain, and Saratoga. 1997-98 enrollment includes 1,004 students: 472 elementary, 211 middle school, and 321 high school (Verplancke 1997). Carbon County School District No. 1 includes schools in Rawlins (a high school, a middle school, and three elementary schools), Baggs, Bairoil, and Sinclair. 1997-98 enrollment includes 2,059 students: 863 elementary, 432 middle school, 659 high school, and 105 special education students (Schmidt 1997). The schools in both districts are not crowded and are capable of handling higher enrollments.

3.4.5 Local Government Taxation and Revenue

Property taxes are determined by multiplying the assessed value of properties by the tax rate (mill levy). Residential and commercial properties are assessed at 9.5% of market value, industrial properties at 11.5%, and mineral and mine products at 100% (Wyoming Taxpayers Association 1993). The county collects taxes for the county, as well as cities, towns, school districts, and special districts, and each jurisdiction receives revenue according to the mill levy for that jurisdiction. The 1997 mill levy for Carbon County was 63.84 mills in School District 1 and 72.74 mills in School District 2, and based on an assessed valuation of approximately $325.5 million, the county collected taxes totaling approximately $22.4 million (Stubbs 1997). Cyprus-Shoshone is anticipated to pay approximately $3.15 million in property taxes to Carbon County in 1997, whereas Arch will pay approximately $1.7 million on its two surface mine operations (Stubbs 1997). Cyprus-Shoshone and Arch were the second and fourth largest taxpayers, respectively, in Carbon County in 1997.

State sales tax is 4% and Carbon County sales tax was an additional 1%, but increased to 2% in fall 1997 election. Sales tax collections for fiscal year 1996 in Carbon County were approximately $8.2 million. Twenty-eight percent of the state sales and use taxes are distributed to local government. In 1997, more than $4 million were distributed to Carbon County and the various cities and towns in the county, including, but not limited to: Carbon County, $541,676; Elk Mountain, $44,761; Hanna, $259,970; Medicine Bow, $94,106; Rawlins, $2,266,149; Saratoga, $475,690; and Sinclair, $120,764 (Wyoming Department of Revenue 1997).

3.4.6 Community Characteristics, Facilities and Infrastructure

In the past, when oil field jobs were available in the surrounding region, up to 400 people lived in McFadden. At present, two families reside there. An oil company continues to maintain a work camp in the town. Electricity is provided by Carbon Power and Light Company, water is obtained from wells, sewage is disposed of with septic systems, and no solid waste disposal services are available.

Elk Mountain developed as an outpost on the Overland Trail and presently serves as a gateway from I-80 to the Medicine Bow National Forest. Elk Mountain's police protection is provided by the Carbon County Sheriff, and fire protection is provided by a volunteer fire department. The city has a park and a library with 2,000 volumes. Elk Mountain's unique attraction is the Elk Mountain Hotel. Electrical service is provided by Carbon Power and Light and water by the Town of Elk Mountain. Sewage treatment and solid waste disposal services are available.

Hanna developed as a coal-mining community along the Union Pacific Railroad line. Hanna is served by a two-person police department and an 18-person volunteer fire department. The Hanna library contains 8,000 volumes. Recreational facilities include two baseball fields, two tennis courts, one swimming pool, one soccer field, one skating rink, one recreation center, and one park. Hanna's unique attractions include the Miner's Monument and the Union Pacific snow plow in the town park. Utility providers include Pacific Power and Light Company for electricity, Northern Gas Company of Wyoming for natural gas, and the Town of Hanna for water. Sewage treatment and solid waste disposal service are available.

Medicine Bow developed as a station stop for the Union Pacific Railroad in the 1860s and later became a stopping point on the Lincoln Highway during the 1930s. The town has a one-person police department, a 15-person volunteer fire department, and a 2,000-volume library. Recreational facilities include one baseball field and one tennis court. Unique attractions are the Virginian Hotel and the Medicine Bow Museum. Utility providers are Hot Springs Rural Electric Association for electricity, Northern Gas Company of Wyoming for natural gas, and the Town of Medicine Bow for water. Sewage treatment and solid waste disposal services are available.

Rawlins is the county seat and principal commercial and administrative center in Carbon County. Rawlins's police department has 20 full-time personnel, and the fire department has eight full-time personnel and 20 volunteers. A 93-bed hospital serves Rawlins and the surrounding region. The city's library has 60,000 volumes. Recreational facilities include nine baseball fields, eight tennis courts, one swimming pool, one bike path, four soccer fields, one skating rink, one recreation center, and eight parks. Unique attractions include the Frontier Prison and Outlaw days and the County Fair and Rodeo in August. Utility providers are Pacific Power and Light for electricity, Northern Gas Company of Wyoming for natural gas, and the City of Rawlins for water. Sewage treatment and solid waste disposal services are provided.

Saratoga is known for its hot springs. The town is served by a 12-person police department and a fire department with 32 volunteers. Saratoga has a 10,000-volume library. Recreational facilities include five baseball fields, two tennis courts, two swimming pools, two golf courses, two soccer fields, two skating rinks, and five parks. Unique attractions are the hot springs and historic/cultural center. Utility providers are Carbon Power and Light Company for electricity, Northern Gas Company of Wyoming for natural gas, and the Town of Saratoga for water. Sewage treatment and solid waste disposal services are available.

Sinclair has a two-person police department, a volunteer fire department of 15, and a 7,000-volume library. Recreational facilities include one baseball field, one tennis court, one golf course, one skating rink, one recreation center, and two parks. Unique attractions are Spanish architecture and Parco/Sinclair National Historic Museum. Utility providers are Pacific Power and Light Company for electricity, Northern Gas Company of Wyoming for natural gas, and the Town of Sinclair for water. Sewage treatment and solid waste disposal services are available.

Law enforcement in rural areas is provided by the Carbon County Sheriff's Department. Carbon County has about 25 officers (full-time, part-time, and detention facility).

Regional recreation attractions include the Medicine Bow National Forest (in southwestern Albany County and southeastern Carbon County), Snowy Range Ski Area (southwestern Albany County), and Seminoe Reservoir and State Park in central Carbon County.

3.4.7 Transportation

Surface transportation in Carbon County is provided by an approximately 1,200-mi network of roads that includes 90 mi of paved road, 250 mi of gravel road, and 928 mi of dirt road (Pedersen 1996). I-80 is the principal roadway servicing intercontinental traffic across southern Wyoming. Within Carbon County, I-80 links the communities of Arlington, Elk Mountain, Walcott, Sinclair, and Rawlins and is just south of the proposed mine. Highway 30/287 runs north of the project area, through Medicine Bow and just south of Hanna, joining I-80 at Walcott. Highway 72 joins I-80 and Highway 30/287 and runs generally north/south just west of the proposed mine. County Road 215 is within the CBCPA (see Figure 1.1) and would be upgraded and used to access Highway 72 from the mine. County Road 3 runs north/south between Medicine Bow and Exit 205 on I-80, east of the CBCPA boundary.

I-80 west of Arlington had a traffic volume of 8,500 vehicles per day in 1996, including 4,355 trucks; Highway 72 between I-80 and Highway 30/287 had a 1996 traffic volume of 290 vehicles per day, including 40 trucks; Highway 30/287 between Hanna and Walcott had 870 vehicles per day, including 145 trucks; and Highway 30/287 between Hanna and Medicine Bow had 510 vehicles per day, including 100 trucks (Whipple 1997).

The main line of the Union Pacific Railroad runs west from Laramie through Medicine Bow, Hanna, and Rawlins and is a major east/west rail line through the central U.S. Rawlins has a large switchyard for this double-track system. Small public airports are located in the city of Rawlins and the town of Saratoga. None provide scheduled flights, but chartered flights are available.

3.4.8 Environmental Justice

Environmental justice issues are concerned with actions that unequally impact a given segment of society as a result of physical location, perception, design, noise, etc. On February 11, 1994, Executive Order 12898, *Federal Action to Address Environmental Justice in Minority Populations and Low-Income Populations* was published in the Federal Register (59 Fed. Reg. 7629). The Executive Order requires federal agencies to identify and address disproportionately high and adverse human health or environmental effects of

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its programs, policies, and activities on minority populations and low-income populations (defined as those living below the poverty level). The Executive Order makes clear that its provisions apply fully to Native American populations and tribes, specifically to affects on tribal lands, treaty rights, trust responsibilities, and the health and environment of Indian communities.

Communities within Carbon County, entities with interests in the area, and individuals with ties to the area all may have concerns about the presence of a coal mine in the area. Communities potentially impacted by the presence or absence of a coal mine have been identified above in the socioeconomic section (Section 3.4) of this EIS. Environmental justice concerns are usually directly associated with impacts on the natural and physical environment, but these impacts are likely to be interrelated with social and economic impacts as well.

Native American access to cultural and religious sites may fall under the umbrella of environmental justice concerns if the sites are on tribal lands or access to a specific location has been granted by treaty right. With regard to environmental justice issues affecting Native American tribes or groups, the CBCPA contains no tribal lands or Indian communities, and no treaty rights or Indian trust resources are known to exist for this area.

3.5 LAND USE

Of the 18,360-acre CBCPA, 3,266 acres (18%) are federal surface administered by the BLM; 13,649 acres (74%) are private surface; and 1,445 acres (8%) are state-owned surface managed by the State of Wyoming for the State School Trust (Figure 3.15). Landownership in the CBCPA vicinity is primarily a checkerboard pattern of alternating federal and private ownership. Ownership of in-place coal reserves in the CBCPA are: federal--149.7 million tons or 39%, private--230.7 million tons or 60%, and state--5.2 million tons or 1%.

Major land uses within and adjacent to the project area are agriculture (primarily cattle and sheep grazing); wildlife habitat; dispersed outdoor recreation (e.g., hunting, hiking, camping, wildlife observation, nature photography, and off-road vehicle use); and oil and natural gas exploration, development, and transportation. Mining was a previous land use, as exhibited by the numerous abandoned mines in the CBCPA (see Sections 3.1.6 and 3.3.2).

Surveys of Carbon County residents conducted recently as part of the development of a Carbon County land use plan suggested a need to balance the conservation of natural resources and the economic viability of resource-based industries in the county; however, commercial mining activities were viewed favorably by 54% of those responding to the question (Pedersen 1997). The Carbon County Land Use Plan (Pedersen 1997) recommends that areas in the county suitable for surface or underground coal mining be designated to accommodate those uses.

3.5.1 Agriculture/Rangeland

The CBCPA and transportation corridors are primarily within the 31,157-acre, BLM-administered North Anschutz grazing allotment (#0832), which currently provides 5,526 animal unit months (AUMs) or 5.6 acres per AUM. The allotment supports yearlong grazing for cattle and is used by two permittees. The CBCPA includes 2,481 acres of federal surface providing 412 AUMs, 5,976 acres of private surface providing 1,029 AUMs, and 1,240 acres of state surface providing 413 AUMs within the allotment, with the remaining surface uncontrolled by the allotment. Two sections within the CBCPA are within the 57,969-acre BLM-administered Chace grazing allotment, and these 1,280 acres of private surface provides 203 AUMs. The CBCPA, then, provides 2,057 AUMs in 10,977 acres of allotment lands or 5.3 acres/AUM.

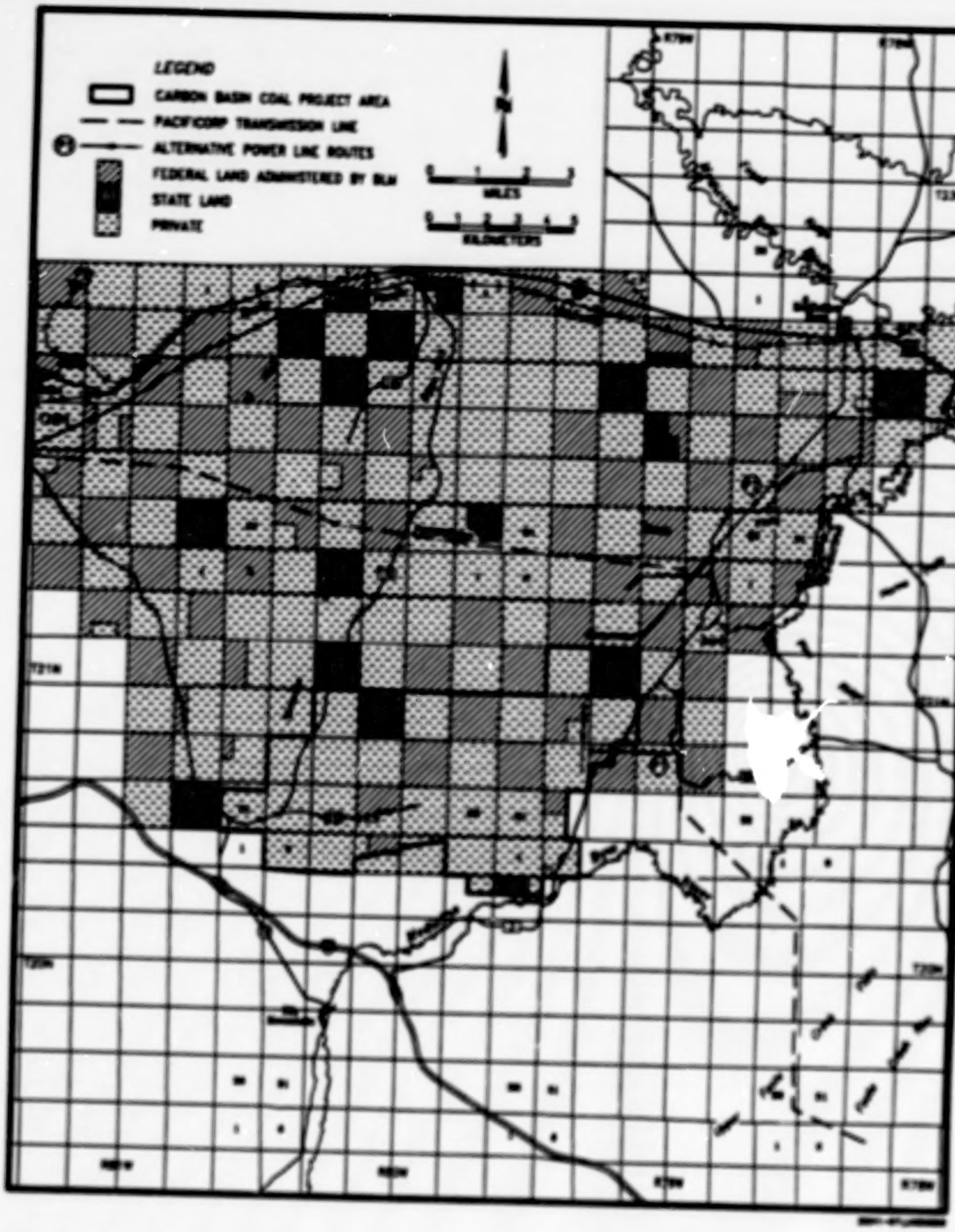
LEGEND
CARBON BASIN COAL PROJECT AREA
PACIFICORP TRANSMISSION LINE
ALTERNATIVE POWER LINE ROUTES
FEDERAL LAND ADMINISTERED BY BLM
STATE LAND
PRIVATE
N
0 1 2 3
MILES
0 1 2 3 4 5
KILOMETERS

Figure 3.15 Landownership.

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Two other grazing allotments--Dana Meadows South and Dana Block North--would be affected by some transportation options. Dana Meadows South (#0829) is located to the north and west of the CBCPA and includes 13,864 acres providing 2,336 AUMs or 5.9 acres/AUM. Dana Block North (#0822) is located north of Highway 30/287 and includes 29,780 acres providing 4,962 AUMs, or 6.0 acres/AUM.

3.5.2 Extractive Mineral Operations/Oil and Gas Production

There are no producing oil or gas wells within the CBCPA or along the transportation corridors (DeBruin and Boyd 1991; WOGCC 1996). The Simpson Ridge field is located just northwest of the CBCPA but is shut-in, and there are no pipelines associated with this field that would require relocation or other protection. Sinclair Oil Corporation does hold several oil and gas leases within the project area. No commercial coal development is presently occurring within the project area.

No locatable minerals are known to exist in economic quantities within or adjacent to the CBCPA; however, salable minerals including sand, stone, and gravel do occur in recoverable quantities, and some quarries are active in the general vicinity of the project area, including sand and gravel pits at Arlington, near Simpson Ridge, and along the Medicine Bow River.

Cyprus-Shoshone, a subsidiary of Cyprus-Amax, operates the only underground coal mine operation in the State of Wyoming approximately 12 mi northwest of the CBCPA. Approximately 5.1 million tons of minable coal remain in the two remaining longwall panels at the south end of the mine, and these will be extracted by about mid-1999. During the mining of these remaining reserves, Cyprus-Shoshone has begun investigations into expanding mining activity to the nearby Barrel Springs area where an estimated 30 million tons of coal reserves are located. Currently, Cyprus-Shoshone has publicly stated that this project is on hold.

Arch has been operating in Carbon County since about 1970 and currently operates the only two surface coal mines in Carbon County--Seminoe II and Medicine Bow. Arch also has the Seminoe I and Edison Development Company Mines which are in the final reclamation and bond release stages.

3.5.3 Recreation

Lands in and adjacent to the CBCPA provide a variety of recreational opportunities to local residents and nonresidents, including camping, off-road vehicle use, cross-country skiing, fishing, hunting, and hiking. However, the checkerboard landownership pattern limits access to some public lands for recreational activities. Recreational use of private lands is controlled by landowners, some of whom charge an access fee for hunting privileges on lands to which they control access. Recreational use of the CBCPA is by permission only.

No recreational use data are available for the analysis area specifically. However, big game hunting is likely the predominant recreational activity. The project area is located in elk Hunt Area 114 of the Snowy Range Herd, pronghorn Hunt Area 46 of the Medicine Bow Herd, mule deer Hunt Area 74 of the Sheep Mountain Herd, and white-tailed deer Hunt Area 74 of the Laramie River Herd. In 1996, 95 elk hunters spent an average of 9.9 days each to harvest 49 elk from Hunt Area 114; 298 pronghorn hunters spent an average of 2.8 days each to harvest 326 pronghorn from Hunt Area 46; 171 deer hunters spent an average of 13.3 days each to harvest 43 mule deer from Hunt Area 74; and 100 deer hunters spent an average of 14.1 days each to harvest 28 white-tailed deer from Hunt Area 74 (WGFD 1997a). Recreational opportunities for hunting pronghorn in the Medicine Bow Herd, expressed as recreation days, has decreased from about 9,000 in each of 1992 and 1993 to 2,366 in 1996. This is due primarily to a decrease in the number of licenses issued by WGFD, which was based on a reduced pronghorn population due primarily to weather-related factors. Recreational opportunities for hunting mule deer in the Sheep Mountain Herd have decreased from about 10,000 days in 1992 to about 7,200 days in 1996 (a 28% decrease), whereas such opportunities for hunting white-tailed deer in the Laramie River Herd have decreased from about 3,500 days in 1992 to 1,682 days in 1996 (a 52% decrease). Recreational opportunities for hunting elk in the Snowy Range Herd have increased from about 32,000 in 1992 to nearly 40,000 in 1996–an increase of about 25%. Additional hunting for sage grouse, mourning dove, cottontails, and predators probably occurs independent of, or in conjunction with, big game hunting.

No developed recreation areas exist within or adjacent to the CBCPA. However, the Wick Wildlife Habitat Area is located approximately 5 mi to the south and east of the CBCPA and includes a number of rustic public camping sites (WGFD 1990). The Wick area is a 10,344-acre WGFD property originally purchased in 1964 for winter elk habitat, but now managed to provide year-round habitat for all species that use the area and to provide public access for quality experience with wildlife.

Regional recreation attractions include the Medicine Bow National Forest, Snowy Range Ski Area (in southwestern Albany County), and Seminoe Reservoir and State Park.

3.5.4 Land Status and Prior Rights

ROW-holders within the CBCPA include:

- Carbon Power and Light (transmission line ROW);
- Utilities of Wyoming (telephone/telegraph ROW);
- Energy Reserves, Inc. (road ROW);
- Carbon County Commission (road ROW); and
- Colorado Interstate Gas Transmission Company (pipeline ROW).

In addition, SeaWest holds a ROW grant to construct and access a Wind Plant in the Simpson Ridge Project area, north and west of the CBCPA (BLM 1997b). The Simpson Ridge Project area overlaps with the CBCPA in sec. 29, T.21 N., R.80 W., but SeaWest and Arch have agreed to use this section cooperatively. PacifiCorp holds a ROW grant to construct and access a 230-kV transmission line north of the CBCPA (see Figure 2.1) which would be crossed by several of the alternative transportation corridors. If PacifiCorp allows Arch to tap into the 230-kV line, there would be no need for a longer line to Medicine Bow. Lease holders along the alternate transportation corridors would not be impacted by any of the options and thus are not discussed further in this EIS.

3.6 VISUAL RESOURCES

The CBCPA is rolling to hilly and dissected by occasional steep ridges. Rock outcrops, riparian areas, ridges, and manmade structures punctuate a plains-type setting. Rangelands are largely vegetated by grasses, sagebrush, mountain mahogany, and snowberry. Where visible, Elk Mountain enhances scenic quality in the CBCPA. Well-vegetated riparian corridors (e.g., the Medicine Bow River) also enhance scenic quality.

The CBCPA and most of the alternate transportation corridors are within a Visual Resource Management (VRM) Class III area. The northwestern portion of corridors B-1, B-2, B-3, C-1, and C-2 are within a VRM Class IV area. VRM objectives for Class III areas allow moderate changes to the existing landscape, but management activities associated with these changes should not dominate the view of the casual observer and changes should repeat the basic elements of the characteristic landscape. VRM objectives for Class IV areas allow changes that may subordinate the original composition and character, but reflect what could be a natural occurrence in the landscape.

There has been little development within the CBCPA and along the transportation corridors such that the natural visual quality is relatively undisturbed. Existing developments that currently affect visual quality include roads, pipelines, telecommunications lines, power lines, mines, PacifiCorp's 230-kV transmission line, and oil and gas development. At the northern ends of the transportation corridors, other developments such as the towns of Hanna and Medicine Bow, the Seminoe II Mine, Miner's Substation, and Highway 30/287 affect existing visual quality.

3.7 HAZARDOUS MATERIALS

Arch evaluated potential hazardous wastes within the CBCPA using existing sources of information. The area was found to be free from obvious environmental degradation within the scope of the hazardous substances and petroleum products identified in the CERCLA. Potential sources of future contamination would include:

- spilling, leaking, and/or dumping of hazardous substances, and/or petroleum products associated with mineral, coal, oil, and/or gas exploration and development and agricultural and livestock activities and
- other sources of contamination not currently obvious or identifiable.

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4.0 ENVIRONMENTAL CONSEQUENCES AND MITIGATION MEASURES

Environmental consequences of construction and operation of the proposed Elk Mountain and Saddleback Hills Mines are discussed below for each potentially affected resource under the No Action Alternative and the Proposed Action and transportation options. An environmental consequence or impact is defined as a modification of the existing environment brought about by development activities. Impacts can be a primary result of the action (direct) or a secondary result (indirect) and can be permanent or long-lasting (long-term) or temporary and of short duration (short-term). Long-term impacts are changes made in the environment during project construction and operation that would remain after 2012, or after the surface mine has closed and been reclaimed. Short-term impacts are effects on the environment that would occur during and immediately after mine development. Impacts can vary in degree from only sightly discernible to a total change in the environment.

The effects of the principal federal action (holding a competitive lease sale) are evaluated relative to the effects of No Action, because the privately owned surface-minable coal could be mined by Arch and up to 3,270 acres would likely be disturbed regardless of BLM's decision on the lease sale. The federal action would cause the disturbance acreage to increase by up to 50% (see Table 2.1), but would not be the sole action that enables surface-disturbing activities in the CBCPA. Therefore, the impact analysis discloses the effects of no federal action and then evaluates how impacts would change if BLM opts to hold a lease sale. The analysis for the No Action Alternative assumes that BLM would grant the necessary ROWs to facilitate mining private coal.

Potential impacts for this project were quantified where practical. In accordance with CEQ regulation 40 CFR 1502.16, this chapter includes a discussion of the direct and indirect effects of the No Action Alternative and Proposed Action and their significance. Pursuant to CEQ regulations concerning the implementation of NEPA, evaluation of the significance of an impact included the following considerations (40 CFR 1508.27):

1) a significant effect existing even if the federal agency believes that the effect would be beneficial;
2) the degree to which the No Action Alternative and Proposed Action affect public health and safety;
3) unique characteristics of the geographic area such as proximity to historic or cultural resources, wetlands, or ecologically critical areas;
4) the degree to which the effects on the quality of the human environment are likely to be highly controversial;
5) the degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks;
6) the degree to which the action may establish a precedent for future actions with significant effects or represents a decision in principal about a future consideration;
7) whether the action is related to other actions with individually insignificant but cumulatively significant impacts;
8) the degree to which the action may adversely affect districts, sites, highways, structures, or objects listed as eligible for listing on the NRHP or may cause loss or destruction of significant scientific, cultural, or historical resources;
9) the degree to which the action may adversely affect T&E species or their habitat that been has determined to be critical under the ESA; and
10) whether the action threatens a violation of federal, state, or local law or requirements imposed for the protection of the environment.

With regards to criteria nos. 1-9, only those criteria that are relevant to the impact analysis for a given resource are disclosed in the analysis. For example, criterion no. 8 refers specifically to cultural resources and thus is not invoked in the analysis for the other resources. With regards to criterion no. 10, the EIS includes management objectives for each resource, and the determination of significance was based on compatibility with management objectives, along with the other nine criteria, as applicable.

Each resource discussed in this chapter includes a description of the following.

- Management objectives. Management objectives, as defined in the GDRA RMP Record of Decision (ROD) (BLM 1990), the Wyoming State Land Use Plan (Wyoming State Land Use Commission 1979), the Carbon County Land Inventory (UW 1991), and the Carbon County Land Use Plan (Pedersen 1997) are defined for each resource, and the No Action Alternative and Proposed Action are assessed for compatibility with these objectives. In this chapter, these objectives are referred to as federal, state, and/or county objectives because the land use and management plans do not necessarily consider each resource that is analyzed herein.
- Impacts. The level and duration of impacts that would occur as a result of the No Action Alternative and Proposed Action are described, and it is assumed that the performance standards and mitigations described in Chapter 5.0 would be effectively implemented to minimize adverse impacts.

Performance standards, mitigation and monitoring requirements are described in Chapter 5.0. If additional measures are deemed necessary to mitigate or monitor impacts identified during this analysis, they are described in this chapter and summarized in Chapter 5.0. On private land, Arch has committed to implementing the proposed project with public safety and environmental consciousness within the CBCPA and along transportation corridors for the LOM insofar as landowner preference and agreement allow, but mitigation measures would be implemented per landowner preferences and in conformance with the LQD-approved mine permit.

Cumulative impacts are those that result from the incremental impacts of the proposed project added to past, present, and reasonably foreseeable future actions. The area considered for cumulative impacts varies depending on the resource being analyzed; however, the cumulative impact analysis area (CIAA) for many resources includes the area shown on Figure 4.1 which includes all major disturbances/projects in the region (i.e., the CBCPA; the SeaWest Wind Plant and Medicine Bow Windfarm Project areas; the Seminoe I, Seminoe II, Medicine Bow, Edison Development Company, Rosebud, and Cyprus-Shoshone Mines; the towns of Hanna, Medicine Bow, and Elk Mountain; the Hanna Bypass; oil and gas wells and associated facilities; roads; railroads; and towns) (Table 4.1). Power lines, pipelines, and underground cables are not included in the cumulative impact analysis because the disturbances have been reclaimed. Timber sales are not considered in the cumulative impact analysis because no timber sales are occurring or have occurred sufficiently close to the CIAA to appreciably, if at all, affect CIAA resources.

The CIAA boundary was defined based on notable natural, man-made, and jurisdictional features over which cumulative impacts to resources such as soils, vegetation, water quality, etc., are not likely to extend. The CIAA encompasses approximately 553,000 acres. The resources for which cumulative impacts may extend over this boundary are air quality, big game, and socioeconomics. The air quality cumulative impacts analysis includes an assessment of possible increases in pollutant levels at four wilderness areas in Wyoming and Colorado. Big game cumulative

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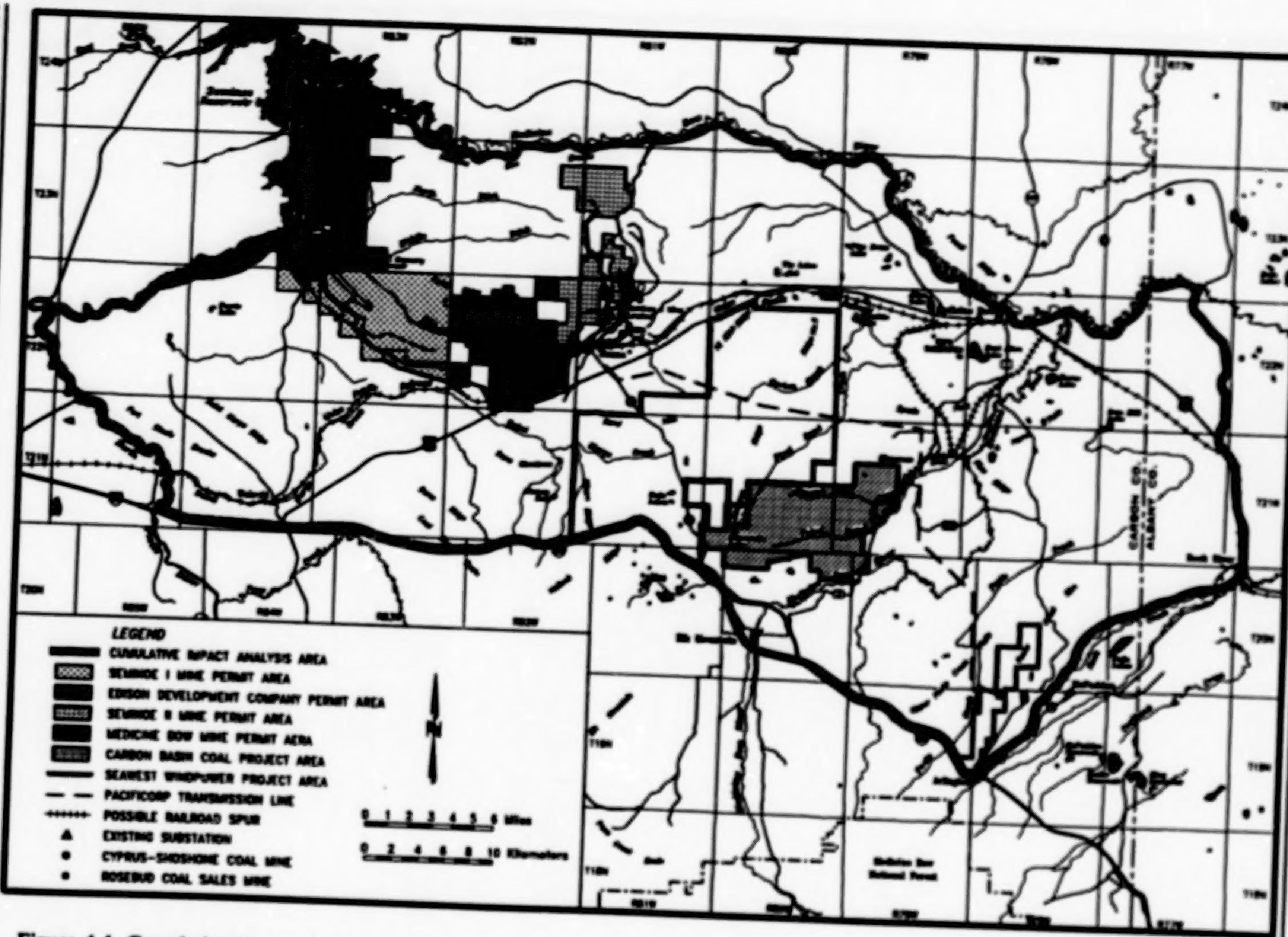
LEGEND
CUMULATIVE IMPACT ANALYSIS AREA
SEMINOE I MINE PERMIT AREA
EDISON DEVELOPMENT COMPANY PERMIT AREA
SEMINOE II MINE PERMIT AREA
MEDICINE BOW MINE PERMIT AERA
CARBON BASIN COAL PROJECT AREA
SEAWEST WINDPOWER PROJECT AREA
PACIFICORP TRANSMISSION LINE
POSSIBLE RAILROAD SPUR
EXISTING SUBSTATION
CYPRUS-SHOSHONE COAL MINE
ROSEBUD COAL SALES MINE
0 1 2 3 4 5 6 Miles
0 2 4 6 8 10 Kilometers
N
Medicine Bow National Forest

Figure 4.1 Cumulative Impact Analysis Area.

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Table 4.1 Acreage of Major Sources of Existing and Proposed Disturbance Within the Carbon Basin Coal Project CIAA.[1]

Disturbance	Permit Area	Area Currently Disturbed or Proposed for Disturbance	Reclaimed Area
Mines[2]			
CBCPA	18,360	4,896	n/a
Medicine Bow Mine	20,352	5,341	3,421
Seminoe I	14,761	4,547	4,495
Seminoe II	9,596	3,422	1,901
Edison Development Co.	13,250	2,024	1,719
Rosebud	12,670	700[3]	6,027[3]
Cyprus-Shoshone	5,265	322	83[4]
Subtotal	94,254	21,252	17,646
Windfarms			
SeaWest Wind Plant	60,619	1,787	n/a
Medicine Bow Windfarm	n/a	1,154	n/a
Oil and Gas[5]	n/a	31	n/a
Roads[6]	n/a	8,447	n/a
Railroads[7]	n/a	732	n/a
Towns[8]	n/a	560	n/a
Total	154,873	33,963	17,646

[1] See Figure 4.1 for the CIAA location.
[2] Personal communication, January 1998, with Ed Turner, Arch.
[3] Personal communication, March 1998, with Joe Dallmann, Rosebud.
[4] Personal communication, March 1998, with Rita Clark, Cyprus Coal Company.
[5] WOGCC (1995). Assumes 2.6 acres of disturbance per well (i.e., 0.7 acres for the wellpad and 1.9 acres [40-ft wide by 0.4-mi long] of access road).
[6] Based on BLM 1:100,000 scale topographic maps. Assumes an average disturbance width of 48 ft.
[7] Based on BLM 1:100,000 scale topographic maps. Assumes an average disturbance width of 100 ft.
[8] Approximation based on BLM 1:100,000 scale topographic maps for all or portions of the towns of Hanna, Elmo, Medicine Bow, McFadden, and Rock River.

impacts were analyzed for each herd unit area. The socioeconomic CIAA includes all of Carbon County.

Past use of the CIAA has included livestock and wildlife grazing and foraging, gas and oil production, coal mining and other extractive mineral operations, recreation, and transportation. These uses are expected to continue into the future. Reasonably foreseeable developments would include the following.

- SeaWest Energy Corporation currently holds a ROW grant to construct and access wind turbines on 16,973 acres of federal land in the Foote Creek Rim and Simpson Ridge project areas (BLM 1997b). A Wind Plant is presently under construction at Foote Creek Rim and will involve erection of approximately 133 wind turbines and associated facilities on approximately 960 acres of federal land. Phased development (i.e., 50-100 megawatts [approximately 80-160 turbines] per year) within the Simpson Ridge area is expected to commence within the next few years (BLM 1997b). Total disturbance would be approximately 1,787 acres.
- Windfarm development near Medicine Bow which would utilize approximately 6,400 acres of federal land. Total disturbance would be approximately 1,154 acres. Schedule for this development is unknown.
- Small-scale oil and gas development, on the order of a few wells per year, on existing leases.

To avoid redundancy in this chapter, the effects of one or more transportation option may be discussed under a single heading, especially if the effects are similar. Where effects are sufficiently different to warrant separate sections, the transportation options are discussed separately.

4.1 PHYSICAL RESOURCES

4.1.1 Climate

In the U.S., annual CO$_2$ emissions due to fossil fuel burning totaled 5.7 billion tons in 1989; sulfur dioxide (SO$_2$) emissions in 1990 totaled 15.6 million tons, and nitrogen oxides (NO$_x$) emissions totaled 8.0 million tons (National Acid Precipitation Assessment Program 1993; U.S. Congress 1991). These pollutants, among others, create biological hazards including, but not limited to, human health effects, acid deposition, and potential global warming (i.e., climate change). The issue of climate change is still debated among experts, so a definitive conclusion on the climatic consequences of the No Action Alternative and the Proposed Action is not possible at this time. Microclimates in the CBCPA vicinity would likely be affected (e.g., vegetation removal would cause warmer soil temperatures during sunny periods) but these effects are not expected to be significant; regional or global climate may or may not be affected.

4.1.2 Air Quality

The federal, state, and/or county management objectives for air quality are as follows:

- to comply with all applicable ambient air quality standards;
- to prevent the deterioration of air quality beyond applicable local, state, or federal standards and to enhance air resources, where practicable; and
- to prevent impairment of important scenic values that may be caused by declining air quality (there are no scenic vistas in the CBCPA vicinity so this objective is not applicable to this EIS).

WDEQ-AQD has adopted regulations for the attainment and maintenance of ambient air quality standards (WDEQ-AQD 1989). Section 21 of the

Wyoming air quality control regulations requires any new or modified source of air contaminants to obtain a construction permit before work commences. Emissions sources that require a state permit must apply best available control technologies to all activities and operations with consideration for technical and economic feasibility. The federal and state regulations list specific measures to be considered for large mining operations. Arch would meet all of the management objectives listed above; therefore, air quality effects would not be significant. Management objectives would be achieved.

Under the No Action Alternative and the Proposed Action, the following activities could cause adverse air quality impacts:

- mine, road, power line, railroad, coal-handling facility, and other facility construction;
- topsoil and overburden removal;
- drilling and blasting;
- dragline and shovel operations and truck loading;
- haul truck and other traffic;
- coal crushing, screening, transfer, conveyance, and storage;
- bulldozer and grader operation;
- facilities operation and maintenance;
- erosion of exposed areas; and
- reclamation activities.

Impacts from these activities would include emissions of typical air pollutants including fugitive dust, SO_2, NO_x, volatile organic compounds (VOCs), and CO (Table 4.2). Use of dust suppressants (e.g., magnesium chloride) would reduce fugitive dust emissions by 40-90% (EPA 1988) over uncontrolled levels. To further reduce fugitive dust emissions, Arch would establish and enforce speed limits (15-30 mph) on all project roads in and adjacent to the CBCPA. LOM pollutant emissions (see Section 4.1.2.1) were estimated using EPA AP-42 guidelines (EPA 1993).

4.1.2.1 Emissions Inventory

No Action Alternative. Under the No Action Alternative, maximum particulate matter less than 10 microns in diameter (PM_{10}) emissions (634.13 tons) (Table 4.2) would occur in 2005. Because dust levels would be controlled to within AQD standards, dust, including coal dust, is not expected to affect local ranches. Maximum estimated emissions of SO_2, NO_x, VOCs, and CO would occur in 2005 and would be as follows: SO_2 - 10.70 tons, NO_x - 111.11 tons, VOCs - 7.10 tons, and CO - 46.62 tons.

Petroleum fuel products would be stored in aboveground tanks with approximate storage capacities of 10,000 gallons of diesel fuel, 5,000 gallons of gasoline, and 20,000 gallons of other unspecified petroleum products. VOC emissions from fixed-roof storage tanks depend on tank size, shape, and condition; the vapor pressure of the liquid; fuel utilization rate; and atmospheric conditions (EPA 1993). Diesel storage is expected to result in very low emissions because of the low vapor pressure of the product. Gasoline and other petroleum products with higher vapor pressures would have higher VOC emissions; VOC emissions from fuel storage tanks under the No Action Alternative would be less than 0.5 tons per year (tpy).

Proposed Action. Maximum PM_{10} emissions from mining activities would be 438.24 tpy (see Table 4.2) and would be highest in 2005 (438.24 tons), during peak production from the surface mine. Compared to mining associated with the No Action Alternative, the Proposed Action would result in a 1-14% increase in PM_{10} emissions.

SO_2, NO_x, VOCs, and CO would be emitted as by-products from burning fuel in internal combustion engines. At peak production from the surface and underground mines in 2009, an estimated maximum of 11.88 tons SO_2, 121.27 tons NO_x, 7.41 tons VOCs, and 50.73 tons CO would be emitted, primarily as tailpipe

Table 4.2 Emissions Summary for the No Action Alternative and the Proposed Action.

	PM_{10}		SO_2		NO_X		VOC		CO	
Alternative	tpy[1]	%[2]	tpy[1]	%[2]	tpy[1]	%[2]	tpy[1]	%[2]	tpy[1]	%[2]
NO ACTION ALTERNATIVE										
Mining										
Low[3]	121.36	–	0.12	–	1.55	–	0.15	–	0.65	–
High[3]	384.53	–	10.70	–	110.34	–	6.93	–	46.04	–
Transportation										
Low	155.91	–	0.00	–	0.00	–	0.00	–	0.00	–
High	249.60	–	0.00	–	0.77	–	0.17	–	0.58	–
Total										
Low	277.27	–	0.12	–	1.55	–	0.15	–	0.65	–
High	634.13	–	10.70	–	111.11	–	7.10	–	46.62	–
PROPOSED ACTION										
Mining										
Low	122.43	1	0.27	125	3.34	115	0.31	107	1.37	111
High	438.24	14	11.88	11	121.27	10	7.41	7	50.73	10
Transportation Option 1[4,5]										
Low	2.38	-55	1.54	1408	10.31	781	2.61	1847	3.75	688
High	363.42	26	9.29	98	60.27	63	15.31	220	21.18	54
Transportation Option 3[4]										
Low	3.48	-55	1.29	1200	9.99	760	1.38	1027	3.51	651
High	102.36	-15	9.29	98	60.27	63	15.31	220	21.18	54
Transportation Option 6[4,5]										
Low	3.48	130	1.51	10075	18.38	8254	1.62	5713	7.35	8203
High	406.51	33	18.46	184	154.14	148	15.65	225	62.85	144
Transportation Option 8[4,5]										
Low	3.48	-55	1.21	1133	9.99	760	1.30	973	3.51	651
High	108.96	-14	9.29	98	60.27	63	15.31	220	21.18	54
Transportation Option 9[4]										
Low	92.16	-23	0.70	708	8.55	667	0.75	607	3.42	637
High	241.46	7	9.54	100	89.09	89	4.03	61	38.18	91
Transportation Option 10[4]										
Low	0.00	-56	0.00	125	0.00	115	0.00	107	0.00	111
High	103.30	-15	0.69	17	8.32	17	0.73	13	3.33	16

[1] Tons per year.

[2] Percent reduction (-) or increase. Proposed Action mining is compared with No Action Alternative mining. The transportation options are added to the Proposed Action mining and compared with the No Action Alternative total.

[3] Emissions were predicted by year over the LOM. Data from the year(s) with lowest emissions are referred to as "Low"; data from the year(s) with highest emissions are referred to as "High".

[4] Transportation option 1 = over-the-road haulage followed by rail haulage; transportation options 2-3 = rail haulage only; transportation options 4-6 = new haul road haulage followed by rail haulage; transportation options 7-8 = conveyor followed by rail haulage; transportation option 9 = haul road haulage only, no railroad; transportation option 10 = conveyor only, no rail haulage.

[5] When options are the same except for different routes (e.g., 1 and 2, 4-6, 7 and 8), the longest route is shown, therefore the greatest emissions.

emissions from construction and within-mine traffic. Compared with the No Action Alternative, the Proposed Action would result in a 7-11% increase in emissions of SO_2, NO_x, VOC, and CO.

Emissions from fuel storage tanks would likely be less than 0.5 tpy; similar to the No Action Alternative.

Emissions of each pollutant except PM_{10} would be higher under the Proposed Action plus any of the transportation options. Increases in maximum SO_2 emissions would range from 17-184%. Maximum NO_x and VOC emissions would increase by 17-148% and 15-225%, respectively. Maximum CO emissions would increase by 16-144%. PM_{10} emissions from transportation options 3, 8, and 10 would be 15%, 14%, and 15% lower than for the No Action Alternative.

Transportation option 6 (the longest haul route) would result in the greatest emissions of all five major pollutants. Combined with emissions from mining activities under the Proposed Action, this option would result in a 33-225% increase in emissions compared to the No Action Alternative. The other haul road options would likely cause similar increases.

Transportation option 9 would have the lowest increase in emissions of four pollutants, and PM_{10} emissions would be lower compared with No Action Alternative.

Estimated emissions from the proposed Carbon Basin coal project are comparable to the maximum permitted emissions for the Seminoe II and Medicine Bow Mines (Table 4.3). Estimated minimum emissions from the Proposed Action in conjunction with transportation option 6 (which is the highest emission scenario) are 75 to 91% lower than maximum permitted levels at the Medicine Bow Mine (which has higher levels of maximum permitted emissions than the Seminoe II mine). Estimated maximum emissions from the Proposed Action and option 6 are 4 to 115% higher than the maximum emissions permitted at the Medicine Bow II mine. Thus, the estimated emissions from the Carbon Basin coal project are reasonable and slightly conservative (e.g., perhaps overestimating emissions) when compared with maximum allowable emissions from other mines in the area.

4.1.2.2 Near-field Modeling

Near-field modeling was completed to identify the maximum predicted concentrations of five major pollutants in the vicinity of the CBCPA for comparison with applicable ambient air quality standards and PSD Class II Increments. Based on the results of the emissions inventory, it was determined that pollutant emissions would be highest in 2005, so these data were used to run the ISC3 atmospheric dispersion computer model to quantify the potential worst-case emissions of TSP, PM_{10}, NO_x, SO_2, and CO from the Proposed Action. Haulage along Highway 72 was also included in the model because pollutant emissions from over-the-road haul truck traffic on this haul route would affect more people than would the other haulage options.

The No Action Alternative was not modeled because BLM is primarily concerned that the federal action would not result in violations of applicable ambient air quality standards.

Meteorology. Since no site-specific meteorological data are currently available, meteorological data collected from Arch's Seminoe II Mine (located approximately 10 mi northwest of the CBCPA) was selected to best represent atmospheric transport and dispersion conditions within the CBCPA. The most recent full year of data, 1997, was used. Wind speed and wind direction (Figure 4.1), temperature, and sigma-theta (a measure of turbulence in the atmosphere) were combined with twice-daily mixing height data from Lander, Wyoming on an hour-by-hour basis using an EPA-approved meteorological data processor. A windrose plot of

Table 4.3 Comparison of Estimated Emissions from the Proposed Carbon Basin Mine with Maximum Permitted Emissions from the Seminoe II and Medicine Bow Mines, 1997.

Pollutant	**Estimated Emissions for the Carbon Basin Coal Project**[1]	**Maximum Permitted Levels**	
		Seminoe II Mine	**Medicine Bow Mine**
PM_{10}	125.91 - 844.75	83.6	519.9
SO_2	1.78 - 30.34	3.4	14.1
NO_x	21.72 - 275.41	35.2	151.4
VOC	1.93 - 23.06	2.6	12.8
CO	8.72 - 113.58	41.2	108.5

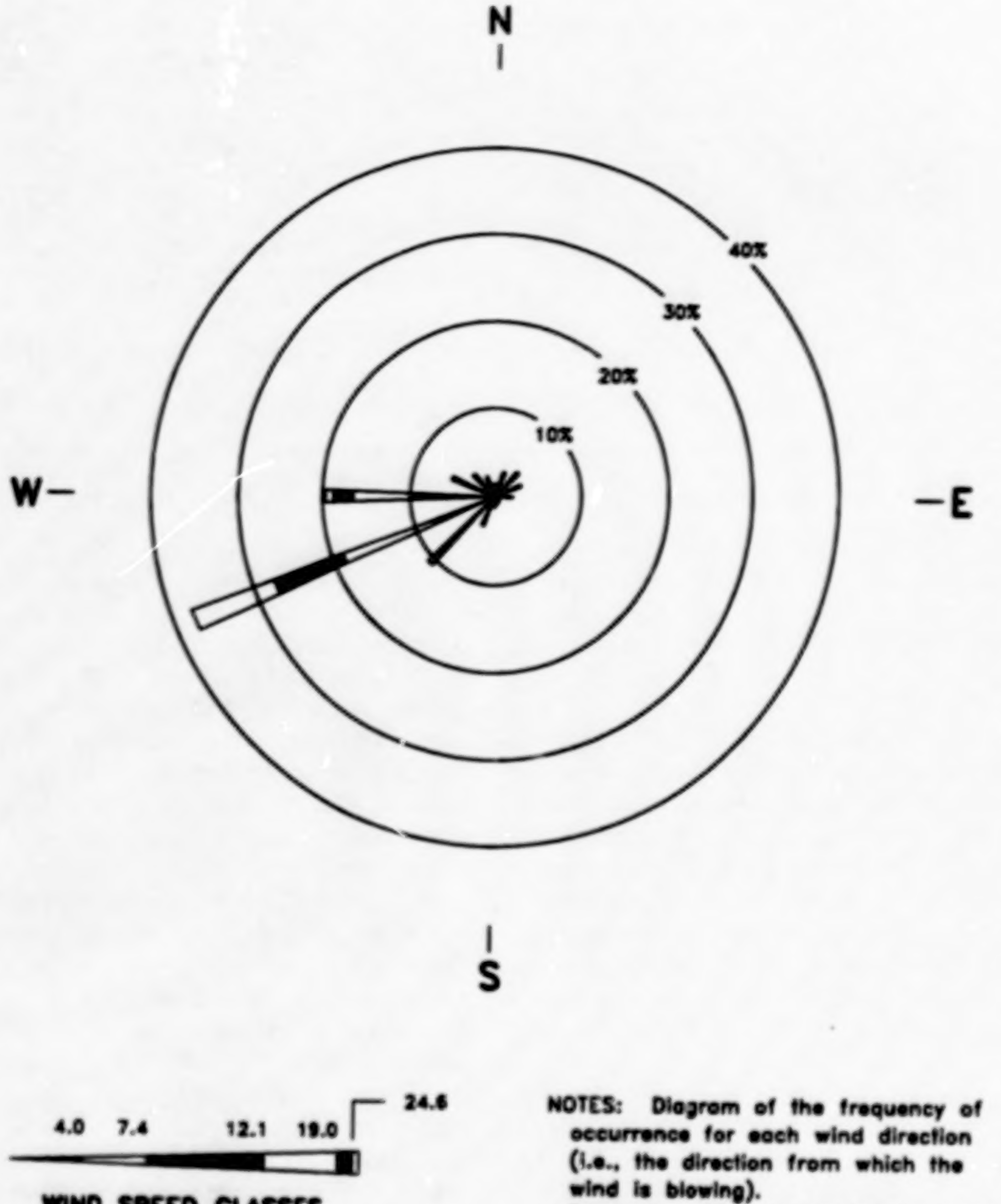
[1] Proposed Action mining activities plus transportation option 6 highest estimated emissions (see Table 4.2).

Seminoe II Mine on-site data is shown in Figure 4.2.

Background Pollutant Concentrations. Background concentrations for all pollutants are shown in Table 4.4. When background concentrations for short-term averaging periods are added to maximum modeled concentrations, the resulting total concentration is very conservative because the meteorological conditions that lead to maximum background concentrations are not the same meteorological conditions that prompt maximum mine impact concentrations.

Model Results. The dispersion model was run using emissions data (see Section 4.1.2.1) from all mining and hauling activities within the CBCPA during 2005. The mining year 2005 was chosen as worst-case because it had the highest anticipated total pollutant emissions and because it had the most coal haulage along both paved and unpaved roads. The model requires the locations of the sources of pollution as well as receptor locations. For modeling purposes, emissions sources were located within proposed surface mining areas, along the primary haul road (unpaved) within the CBCPA, and along a segment of Highway 72. Model receptors (at which pollutant concentrations were calculated) were placed at the CBCPA boundary and at regular intervals for up to 1.0 mi from the CBCPA in areas to which the public would have access. Again, the approach is conservative because the highest ambient concentrations from fugitive emissions sources such as mines typically occur closest to the source and deplete rapidly with distance; model receptors were placed up to 1.0 mi from the CBCPA boundary to ensure that maximum concentrations were identified.

Maximum modeled impacts for each pollutant are compared to NAAQS, WAAQS, and applicable Class II PSD increments in Tables 4.5 and 4.6 and on Figures 4.3 and 4.4. The measured background pollutant concentrations discussed in this section are added to modeled concentrations and also compared to NAAQS and WAAQS. Modeled contributions from the Carbon Basin Coal Project alone are compared to PSD increments, as required by WDEQ.



NOTES: Diagram of the frequency of occurrence for each wind direction (i.e., the direction from which the wind is blowing).
Example - Wind is blowing from the southwest approximately 38% of the time.

Figure 4.2 Windrose Plot of Seminoe II Mine.

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Table 4.4 Monitored Background Concentrations of Five Major Pollutants.

Pollutant	Averaging Time	Concentration ($\mu g/m^3$)
TSP[1]	24-hour	35
PM_{10}[1]	Annual	18
	24-hour	18
NO_2[2]	Annual	10
SO_2[3]	3-hour	29
	24-hour	18
	Annual	5
CO[3]	1-hour	2,299
	8-hour	1,148

[1] Medicine Bow Mine, 1988 and 1989 (Air Sciences 1990).

[2] Carbon County Underground Coal Gasification Project, June-November 1994 (WDEQ 1997).

[3] Craig, Rifle, and Mack, Colorado, 1980-1984 (Colorado Department of Public Health and Environment 1997).

Table 4.5 Carbon Basin Coal Project Modeled Concentrations vs. NAAQS and WAAQS.

Pollutant	Averaging Period	Modeled Concentration ($\mu g/m^3$)	Background Concentration ($\mu g/m^3$)	Total Concentration ($\mu g/m^3$)	WAAQS/NAAQS ($\mu g/m^3$)
TSP	24-Hour[1]	91.73	35	126.73	150
PM_{10}	Annual	9.52	18	27.52	50
	24-Hour[2]	27.63	18	45.63	150
NO_x	Annual	2.25	10	12.25	100
SO_2	Annual	0.24	5	5.24	60/80
	24-Hour[2]	0.66	18	18.66	260/365
	3-Hour[2]	2.37	29	31.37	1,300
CO	8-Hour[2]	5.93	1,148	1,153.93	10,000
	1-Hour[2]	23.62	2,299	2,322.62	40,000

[1] EPA regulates PM_{10} rather than TSP; however, WDEQ retains the 24-hour ambient standard for TSP.

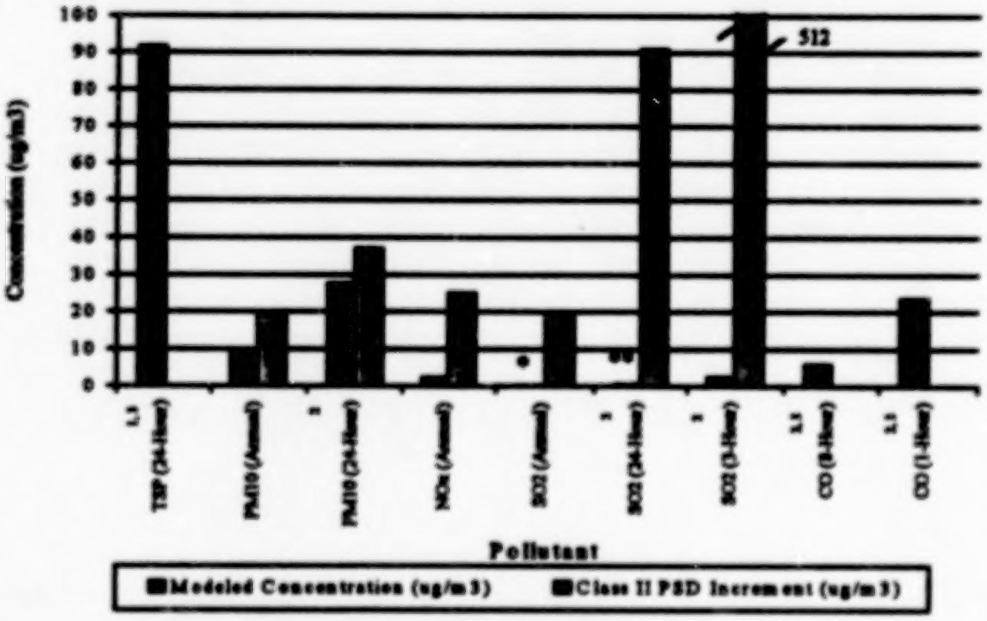
[2] Highest and second-highest concentrations reported for this averaging period.

Table 4.6 Carbon Basin Coal Project Modeled Concentrations vs. Class II PSD Increments.

Pollutant	Averaging Period	Modeled Concentration ($\mu g/m^3$)	Class II PSD Increment ($\mu g/m^3$)
TSP	24-Hour [1]	91.73	--
PM_{10}	Annual	9.52	19
	24-Hour[2]	27.63	37
NO_x	Annual	2.25	25
SO_2	Annual	0.24	20
	24-Hour[2]	0.66	91
	3-Hour[2]	2.37	512
CO	8-Hour [2]	5.93	--
	1-Hour [2]	23.62	--

[1] EPA regulates PM-10 rather than TSP; however, WDEQ retains the 24-hour ambient standard for TSP.

[2] Highest and second-highest concentrations reported for this averaging period.



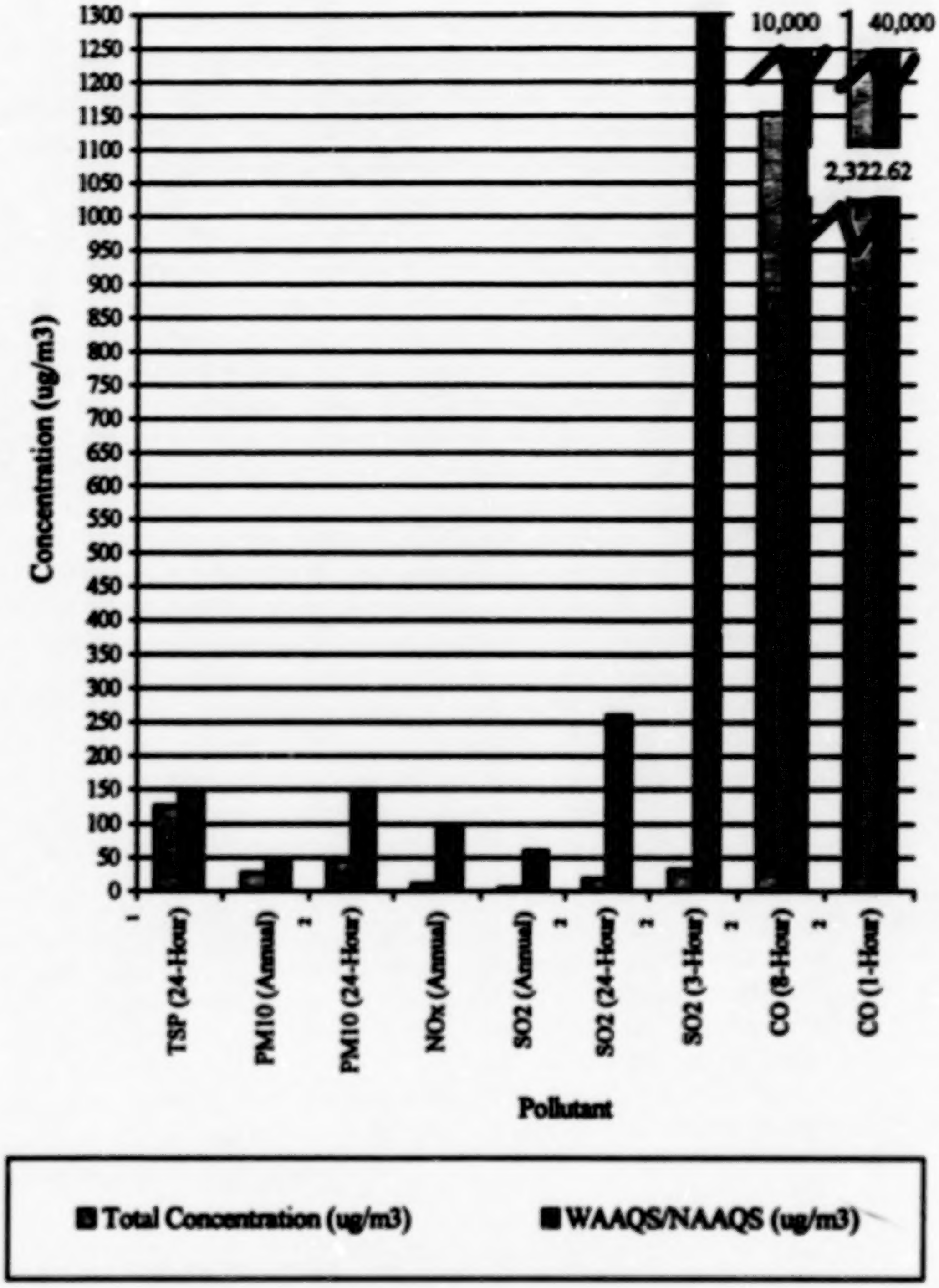
* 0.24 $\mu g/m^3$; ** 0.66 $\mu g/m^3$

[1] EPA regulates PM-10 rather than TSP; however, WDEQ retains the 24-hour ambient standard for TSP.

[2] Highest and second-highest concentrations reported for this averaging period.

[3] There is no Class II PSD Increment for this pollutant.

Figure 4.3 Carbon Basin Coal Project Modeled Ambient Pollutant Concentrations.



[1] EPA regulates PM-10 rather than TSP; however, WDEQ retains the 24-hour ambient standard for TSP.

[2] Highest and second-highest concentrations reported for this averaging period.

Figure 4.4 **Total Concentration of Pollutants for the Carbon Basin Coal Project Area Relative to Wyoming and National Air Quality Standards.**

Table 4.5 shows that during the worst-case year of mining, no exceedances of NAAQS or WAAQS were modeled at or beyond the CBCPA boundary. This demonstration indicates that during mine operation, pollutant concentrations in ambient air at areas of public access will be within the standards developed by EPA and WDEQ for the protection of public health. Furthermore, all concentration contributions are smaller than applicable PSD increments (Table 4.6).

4.1.2.3 Unavoidable Adverse Impacts

Air pollutant emissions would increase as a result of the No Action Alternative and the Proposed Action as described in Section 4.1.2.1-4.1.2.6; however, neither the No Action Alternative nor Proposed Action would cause violations of state and national air quality standards.

4.1.2.4 Cumulative Impacts

Cumulative Impacts. The WDEQ-defined significance level for 24-hour PM_{10} is 5 μg/m3; for annual PM_{10} it is 1 μg/m3. Wyoming guidelines require facilities completing a NAAQS modeling analyses to identify a potential area of significant impact and to include all emissions sources located within that area in subsequent modeling. Worst-case PM_{10} model results from sources within the mine were plotted to show the extent of the area of significant impact for both the 24-hour and annual averaging periods. The 24-hour and annual areas of significant impact are shown in Figures 4.5 and 4.6, respectively. No large pollutant sources are known to exist within these areas of significance. Receptors within the 24-hour area of significance include two occupied residences and wildlife. Wildlife would be the only receptors within the annual area of significance.

The cumulative air quality dispersion modeling results indicate that maximum particulate matter concentrations would comply with all EPA primary and secondary ambient air quality standards at all areas near the mine to which the public can be exposed. Demonstrated compliance with these ambient air quality standards is required before WDEQ and EPA would allow mine construction. Furthermore, demonstrated compliance with secondary standards guarantees minimal environmental impact on numerous air quality-related disciplines, because the secondary standards are protective of a wide range of impacts (Fed. Reg., v.52, No. 126, pp. 24634-24750):

> "A secondary standard ... must specify a level of air quality, the attainment of which, in the judgement of the [EPA] administrator, based on the (scientific) criteria, is requisite to protect the public welfare from any known or anticipated adverse effects associated with the presence of the pollutant in the ambient air. Welfare effects ... include effects on soils, water, crops, vegetation, man-made materials, animals, wildlife, weather, visibility, climate, damage to and deterioration of property, hazards to transportation, and effects on economic values and on personal comfort and well being."

Furthermore, since pollutant concentrations due to the proposed coal mine at areas of public access would be within standards for the protection of public health, residents near the mine would not be adversely affected by air quality impacts. Pollutant concentrations would diminish rapidly with increasing distance from the lease boundary.

Worst-case pollutant emissions from the Proposed Action were also modeled to determine potential impact on Class I and sensitive areas in the region (Table 4.7).

Modeled concentrations for all sensitive areas are shown in Table 4.8 and on Figure 4.7, and the areas designated Class I are compared to Class I PSD increments. Modeled pollutant concentrations at the Class I area nearest the CBCPA, the Savage Run Wilderness Area, are less than 1.4% of the increase allowed under the

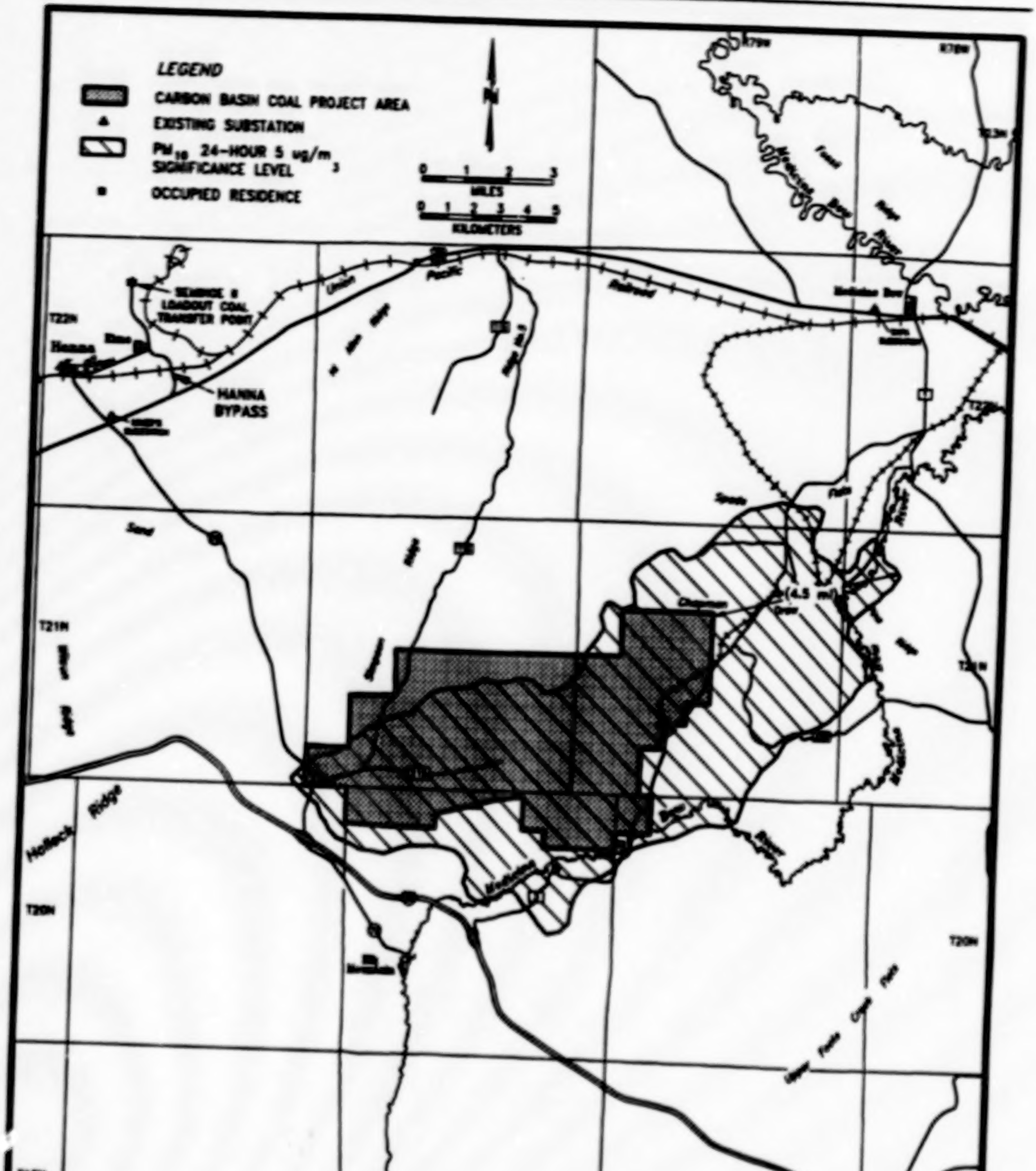


Figure 4.5 24-hour Areas of Significant Impact.

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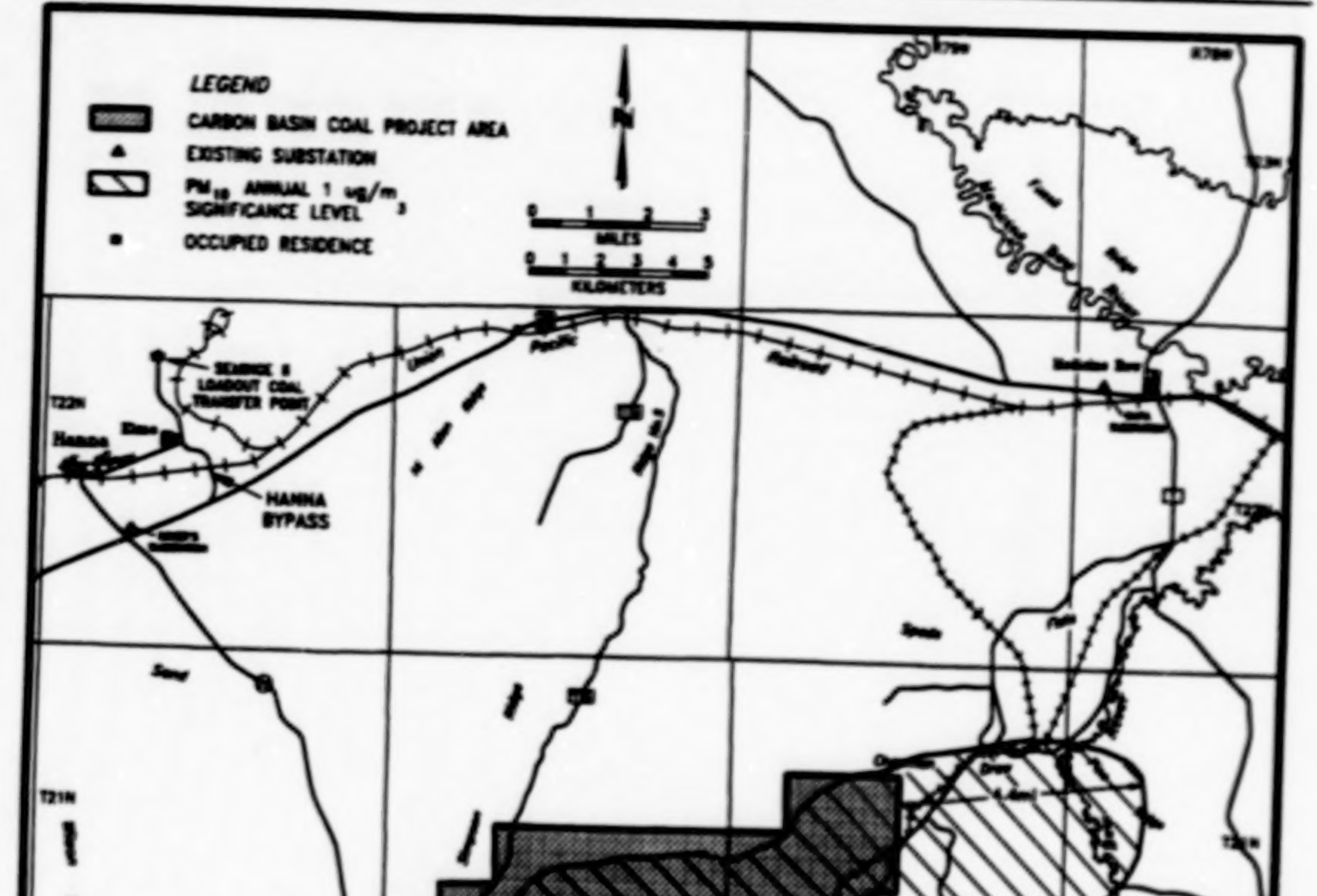

Figure 4.6 Annual Areas of Significant Impact.

Table 4.7 Class I and Sensitive Areas.

Area	Status	Location[1] UTM meters (east/north)	Distance from CBCPA (miles)
Savage Run Wilderness Area (Wyoming)	Class I	369,272/4,600,742	30
Mount Zirkel (Colorado)	Federal Class I	360,876/4,531,076	55
Bridger Wilderness Area	Federal Class I	162,766/4,719,080	150
Fitzpatrick Wilderness Area	Federal Class I	125,539/4,758,947	180
Wild River Roadless Area	Federal Class II	232,191/4,753,902	120
Hanna, Wyoming	–	369,978/4,636,085	10

[1] UTM coordinates relative to UTM Zone 13.

Table 4.8 Carbon Basin Coal Project Modeled Concentrations vs. Class I Increments.

Area	Pollutant	Averaging Period	Modeled Concentration (μg/m³)	Class I Increment (μg/m³)
Savage Run Wilderness Area	PM_{10}	Annual	0.0053	5
		24-Hour	0.14	10
	NO_x	Annual	0.0034	2.5
Mount Zirkel	PM_{10}	Annual	0.0022	5
		24-Hour	0.074	10
	NO_x	Annual	0.0021	2.5
Bridger Wilderness Area	PM_{10}	Annual	0.00002	5
		24-Hour	0.0029	10
	NO_x	Annual	0.00029	2.5
Fitzpatrick Wilderness Area	PM_{10}	Annual	0.00001	5
		24-Hour	0.0015	10
	NO_x	Annual	0.00039	2.5
Wind River Roadless Area	PM_{10}	Annual	0.00004	NA
		24-Hour	0.0070	
	NO_x	Annual	0.00040	
Hanna, Wyoming	PM_{10}	Annual	0.019	NA
		24-Hour	0.63	
	NO_x	Annual	0.0067	

Class I Increment, indicating that long-range effects on air quality will be minimal.

Air quality impacts would be monitored in accordance with the AQD-approved air permit; similar monitoring is required at the other mines in the CIAA. TSP and PM_{10} concentrations from the Medicine Bow and Seminoe II Mines in 1997 averaged 6-48 and 6-37 $\mu g/m^3$, respectively. These emissions, plus emissions of other pollutants from these two mines, will cease around the turn of the century when they close. Oil and gas developments in central and southwestern Wyoming are also bound to monitor pollutant emissions during development, operation, and maintenance, so there is and would be an extensive monitoring network throughout southern Wyoming that, with AQD's oversight, would adequately reveal cumulative effects of these various developments. The impacts of activities that are not explicitly monitored (windpower development, livestock grazing, wildlife movements, on- and off-highway traffic, etc.) actually would be determined during monitoring of major developments because these uses are and would occur proximally. Therefore, monitoring would adequately quantify cumulative effects to air quality.

4.1.3 Topography

As part of the permits to mine, LQD would require Arch to develop detailed mine plans that provide plans for surface water diversions and the maintenance of surface runoff patterns (see Section 5.1 and 5.2). LQD would also require detailed plans for postmining topography which must be designed to support LQD-approved postmining land uses and subsidence monitoring plans which would include provisions to remediate surface disturbances caused by subsidence. Therefore, topographic impacts from the No Action Alternative and the Proposed Action would not be significant.

4.1.3.1 No Action Alternative

The No Action Alternative would have widespread, long-term, and permanent effects on topography. During mining, direct impacts to topography would include short- and long-term disruption of the landscape due to pit excavation and the development of a 175- to 200-ft highwall and 100-ft high spoil piles. Minor surface alterations would occur due to road, railroad, facilities, and power line construction. Drainage patterns would be altered in the mine vicinity; however, all local surface runoff would be diverted around the mine and back into natural channels, and thus regional drainage patterns would not be affected. Direct topographic impacts due to erosion and gully formation are not likely to occur because erosion control measures would be implemented throughout the LOM (see Sections 4.1.7 and 4.1.8.1). An estimated 3,270 acres would be impacted.

There is potential for subsidence over areas that would be mined with the Archveyor™ which would remove a 15- to 20-ft thick coal seam out from under the overlying rock (see Section 4.1.5.1). Archveyor™-related subsidence would cause a 10-ft lowering of the surface, similar to that which would occur in the dragline pits. Potential Archveyor™ subsidence areas (shown on Figure 2.2) as Archveyor™ pits are included in the estimated 3,270 acres of disturbance under the No Action Alternative. Spoils also may be placed on the Archveyor™ disturbance areas, so these areas are counted as actual surface disturbance.

After reclamation, topography in surface-mined areas (including areas mined with the Archveyor™ would be similar to premine topography, with the exception that the overall landscape would be somewhat flatter and approximately 10 ft lower because coal has been removed. Replaced spoil typically occupies more space than the original rocks which will somewhat offset the lowering of the landscape due to coal removal. Some of the prominent ridges and rock outcrops in the area would be removed during mining and replaced with rolling hills.

Road and facilities construction would affect topography due to cutting and filling to make roadways and foundations and from ditches, culverts, etc., for drainage. Power line impacts on topography would be essentially unnoticeable.

Lowering of the landscape due to coal removal and cutting and filling for roads and facilities would not constitute significant effects on the human environment because the postmining landscape would be regraded to blend with the surrounding topography and would support proposed postmining land uses. None of the topographic impacts would violate management objectives.

4.1.3.2 Proposed Action

Under the Proposed Action, impacts to topography due to surface mining would be similar (i.e., not significant) to those described for the No Action Alternative except that there would be more open pits, highwalls, Archveyor™ pits, and spoil and topsoil piles and an additional 837 acres would be disturbed (a 26% increase). Similar to the No Action Alternative, most if not all surface mine disturbances would be reclaimed by 2012.

Impacts to topography due to underground mining would include the subsidence of approximately 7,322 acres (257 of which would already be affected by surface mining), which would result in a gradual lowering of the landscape. (The 7,322 acres potentially affected by subsidence includes all surface lands that overly the underground mine shown on Figure 2.9 plus a 400-ft buffer [see Section 4.1.5.2].) Because subsidence due to underground mining would not cause surface disturbance (e.g., vegetation and soil removal), this acreage was not included in the analysis of effects such as soil loss, direct impacts to wildlife habitat and vegetation, etc. Surface movement due to subsidence would not be perceptible and thus there would be no human or animal safety hazards (see Section 4.1.5). The surface would gradually settle 8.5-10.0 ft over all longwall panels during the year or more following mining (personal communication, February 1998, with Eldon Strid, Mine Engineers; Karafakis n.d.). Along the access entries between panels (i.e., the corridors that would be cut around coal panels), the surface would settle approximately 5 ft, so the area's topography would appear as 400- to 500-ft wide by 2-mi long basins (overlying the mined-out coal panels) that slope gently up to long, linear ridges (overlying the access entries). Subsidence would not occur over the east and south mains because they would be designed to last for the LOM and beyond, so material overlying the mains would stand out as small, linear rises approximately 8.5 to 10.0 ft higher than the surrounding landscape. Lowering of the landscape due to coal removal and subsidence would not constitute a significant effect on the human environment, and none of the topographic impacts would violate management objectives.

Development of transportation options 1 and 2 (over-the-road haulage from 2000 to 2005 followed by railroad haulage from 2005 to 2020) would result in a 1,077- to 1,093-acre (33%) increase in the area disturbed compared with the No Action Alternative due to the increase in the area that would be surface-mined and railroad construction. Railroad construction would impact topography during development of the railroad bed, which would require cut-and-fill construction to create a relatively level grade and would result in minor, long-term landscape alterations. Effects of transportation options 1 and 2 would not be significant.

Development of transportation option 3 (railroad haulage beginning in 2000) would result in a 1,263-acre (39%) increase in disturbance over the No Action Alternative due to the increased area that would be surface-mined and railroad and coal-handling facility construction. This option would require the coal-handling facility to be constructed in a previously undisturbed area which would affect topography (170 acres) due to cutting and filling required to create a level surface for the foundation and surrounding areas. The additional disturbance due to railroad and coal-handling facility construction and operation would exist for the LOM.

If a haul road is constructed (transportation options 4, 5, and 6), there would be 1,360-1,626 acres (42-50%) additional disturbance over the No Action Alternative from grading, cuts and fills, culverts, drainage ditches, etc., during haul road construction. The haul road constructed for these options would result in approximately 10 years (1999-2008) of additional disturbance and related topographic effects but no permanent and significant impacts. Two haul road routes (B-2 and B-3) would follow existing jeep trails for all but a few miles north of Highway 30/287; thus it is likely that BLM and other landowners would require Arch to reclaim the haul road to local road standards (i.e., leave a two-lane gravel road), thus serving to improve existing roads.

Impacts specific to transportation options 7 and 8 would occur due to conveyor and access road construction which would result in 1,160-1,178 acres (35-36%) more disturbance than for the No Action Alternative, but impacts would not be significant. Because the conveyor would be constructed, in part, with cables that must be tightly strung (and thus the conveyor must be relatively straight, like a power line), there is less flexibility to avoid topographically sensitive areas compared with haul road construction. The two alignments (C-1 and C-2) would avoid, as much as possible, steep slopes, playas, riparian areas, and springs. Conveyor construction and operation would result in approximately 10 years (1999-2008) of additional disturbance.

Because alignment C-2 closely parallels existing jeep trails, it is likely that BLM and landowners would require Arch to leave the access road (which would be constructed to higher standards than the existing jeep trails) in place after removing the conveyor and reclaim the existing jeep trails.

Transportation options 9 and 10 would involve the construction of a new coal-handling facility near Medicine Bow, probably in a previously undisturbed area, and would require haul road or conveyor construction but would not require railroad construction. This alternative would result in 1,074-1,298 acres (33-40%) more disturbance compared with the No Action Alternative. As with options B-2 and B-3, the haul road would be constructed along an existing road and thus probably would be reclaimed to local road standards rather than completely reclaimed, depending on landowner preferences. The conveyor would be completely reclaimed during final reclamation (2021-2023). The additional disturbance associated with these options would occur for the LOM.

4.1.3.3 Unavoidable Adverse Impacts

The impacts described for the No Action Alternative and Proposed Action would constitute unavoidable adverse effects on topography.

4.1.3.4 Cumulative Impacts

The existing and proposed mines within the CIAA have had/would have the greatest effects on topography; approximately 21,252 acres (4% of the 553,000-acre CIAA) would be affected by mining and thus subject to an overall lowering and flattening of the landscape, possible subsidence, and runoff retardation. Some old abandoned underground mines in the area have already subsided, but the area of effect is relatively small. Other developments (SeaWest Wind Plant; Medicine Bow Windfarm; oil, gas, and mineral extraction; roads; railroads; towns) have resulted or would result in a localized flattening of the topography. Cumulative topographic changes are/would be widespread and long-term to permanent, but have not and are not expected to affect land use patterns or long-term productivity within the CIAA, and thus are not significant.

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CIAA developments are in conformance with land use management objectives.

Local drainage patterns immediately adjacent to or within the developed project sites have been or would be altered to accommodate drainage ditches, irrigation canals, culverts, diversion, ponds, etc., but the region's overall drainage patterns and the major channels are and would be largely unaffected in form (channel morphology, sediment load, water quality) and function (livestock and wildlife watering, fisheries, irrigation, and domestic and industrial uses). Drainages/watersheds would not be significantly impacted due to cumulative effects.

4.1.4 Geology and Minerals

There are no specific federal, state, or county management objectives for geology, so the geologic analysis was based on land use management objectives. Minerals management objectives are as follows:

- to provide for both short- and long-range development of federal coal in an orderly and timely manner, consistent with the policies of the federal coal management program, environmental integrity, national energy needs, and related demands; to protect important resources by specifying whether federal coal can be leased for surface, subsurface, or in situ mining methods; and to allow analysis of alternative areas in consideration of future leasing activities;
- to provide opportunity for leasing, exploration, and development of oil and gas while protecting other resource values;
- to provide opportunity for leasing, exploration, and development of oil shale, geothermal resources, and nonenergy leasable minerals while protecting other resource values;
- to provide opportunity for location of mining claims and mineral development while prohibiting such activities on lands that are not compatible with these types of activities;
- to provide availability to mineral materials in convenient locations for users while protecting surface resources;
- to achieve a balance between resource conservation and economic development;
- to encourage the exploitation of mineral resources on agricultural land; and
- to designate the Carbon Basin area for future industrial mining.

The No Action Alternative and the Proposed Action are in conformance with management objectives.

4.1.4.1 No Action Alternative

Removal and eventual combustion of approximately 22.45 million tons of surface-recoverable coal would constitute a significant impact because it is nonrenewable. Approximately 209.15 million tons of surface- and underground-minable (see Table 1.1) coal would be bypassed. This would also constitute a significant impact.

An estimated 107,742,000 cu yd of overburden would be removed and replaced during mining. The geologic material would be converted from cohesive strata to broken rock to a depth of 0-250 ft over approximately 1,027 acres within the CBCPA. The replaced overburden would be a relatively homogeneous mixture averaging approximately 80 ft thick (assuming that overburden volume would initially increase approximately 25% followed by compaction to 90% of the increased volume). This increase minus the coal removed would result in an overall reduction of approximately 10 ft. Surface and subsurface geology would be permanently altered by mining, but this would not constitute a significant impact on the human environment because, once reclaimed, the geologic effects would be unnoticeable except to future developers of other minerals.

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Oil, gas, and other mineral exploration and development would be permitted in the CBCPA for the LOM as long as exploration and development would not interfere with coal mine development and operations. The potential for near-future oil and gas development in the CBCPA is slight. There are no known economically recoverable deposits of locatable minerals (e.g., precious metals, bentonite) within the CBCPA (BLM 1989a:126; Harris et al. 1985; Hausel et al. 1994), and there are no leases or claims in the area (BLM 1997a:27), so no impacts to locatable minerals are anticipated. There are numerous construction aggregate quarries in the CBCPA vicinity, but none occur within the project area; therefore, no impacts due to potential conflicts with salable mineral developers are anticipated. Salable minerals (e.g., gravel, aggregate for ballast) would be used during mine, road, and railroad construction, and this use would constitute an irretrievable commitment of resources but would not be a significant impact.

Mine development and operation is not likely to affect the existing Ledder oil field, located approximately 6 mi east of the CBCPA, because blasting would occur within the Carbon Basin which is geologically isolated from the Ledder oil wells. Because the strata are not continuous, seismic waves from blasting are likely to attenuate before reaching the existing wells. No impacts to existing wells in the Ledder field are expected. Since the Simpson Ridge field is plugged, no impacts are expected over-and-above the affects of subsidence on future seismic exploration.

Coal mining would inconvenience but not preclude future seismic tests for oil and gas reserves in the CBCPA because seismic waves do not reliably propagate through broken rock (personal communication, February 1998, with Scott Smithson, UW Department of Geology and Geophysics); therefore, approximately 1,728 acres (pits and Archveyor™ disturbances) disrupted by surface mining would be unsuitable for postmining seismic tests. If the target oil and gas reserves are greater than approximately 10,000 ft below the CBCPA, seismic tests can be completed by undershooting–setting seismic sources and receivers outside of the rubble zone. Undershooting provides reliable seismic data, although it reduces flexibility in locating the seismic tests. Since there are no current proposals to develop these reserves, it is not reasonable to conduct premine seismic tests for oil and gas resources. Because further seismic tests of deeper reserves would be possible, impacts would not be significant. Overburden removal and replacement as rubble would preclude accurate seismic exploration for oil and gas reserves that are shallower than 10,000 ft; this would constitute a significant impact.

4.1.4.2 Proposed Action and Transportation Options 1-10

Under the Proposed Action, an estimated 119.12 million tons of surface- and underground-recoverable coal would be removed and eventually combusted (431% more than for the No Action Alternative). This would constitute a significant impact because it is nonrenewable. An estimated 112.48 million tons of surface- and underground-minable coal would be bypassed; this would also constitute a significant impact.

Approximately 146,765,000 cu yd of overburden would be stripped and replaced over approximately 1,236 acres within the CBCPA. Surface and subsurface geology would be permanently altered as described for the No Action Alternative but over a 20% greater area. Impacts to overburden geology would not be significant.

As with the No Action Alternative, development of other mineral resources within the CBCPA would be permitted during the LOM, provided that it did not interfere with coal mining. Future seismic testing would be limited over approximately 2,107 surface-mined acres and an additional 2,488 acres affected due to subsidence for a total of 7,322 affected acres (a 166% increase over the No Action Alternative).

The Ladder oil field would not be affected under the Proposed Action Alternative for the following reasons.

- As described for the No Action Alternative, seismic waves created by blasting would attenuate prior to reaching the existing wells.
- The underground mine would not undercut the existing oil field; thus there would be no direct impacts due to mining and no indirect impacts due to subsidence.
- None of the alternative transportation facilities would cross the oil field, so access would not be hindered.

Since the Simpson Ridge field is plugged, no impacts are anticipated except the effects of subsidence on future seismic exploration.

Access to mineral resources outside the CBCPA could be affected by the presence of the railroad, haul road, or conveyor, which, because they would be cross-country facilities, could inconvenience developers working in the areas north of the CBCPA. Arch would provide crossings at regular intervals such that each corridor could be safely crossed, thus providing adequate access to other mineral reserves in the area. The presence of transportation facilities, the mine, and the Wind Plant would also limit the placement of oil and gas wells, pipelines, etc.; thus future oil and gas development in the CBCPA vicinity would depend on establishment of cooperative agreements between Arch, the Wind Plant owners, the proposed oil and gas developers, and landowners. Assuming that these agreements can be made, impacts would not be significant.

4.1.4.3 Unavoidable Adverse Impacts

Impacts described for the No Action Alternative and the Proposed Action would constitute unavoidable adverse effects on geology and minerals.

4.1.4.4 Cumulative Impacts

Cumulative impacts to mineral resources would include large-scale removal and combustion of coal from the Hanna and Carbon Basins which is a significant impact because coal is a nonrenewable resource. Access to oil and gas reserves has been/would be hindered due to coal mining on approximately 21,252 acres (4%) within the CIAA. The road network created by the mines and the SeaWest Wind Plant may actually improve access for oil, gas, and mineral development, if cooperative agreements with prior right-holders can be negotiated. However, oil, gas, and mineral development (other than coal) is economically marginal in this area at this time and lease and development applications are few; thus cumulative effects of the various projects are not likely to significantly affect any present or future developers.

4.1.5 Geologic Hazards

The federal, state, and/or local management objectives concerning management of geologic hazards are to promote a pattern of development that takes into consideration the natural constraints to development to ensure a minimum loss of life and property from natural hazards. The No Action Alternative and the Proposed Action would be in compliance with these objectives.

4.1.5.1 No Action Alternative

Under the No Action Alternative, there is potential for approximately 701 acres of surface subsidence over areas that were mined with the Archveyor®. Since the Archveyor® would remove a 15- to 20-ft thick coal seam out from under the overlying rock, there is potential for approximately 10 ft of surface subsidence. Archveyor®-related subsidence would occur imperceptibly slowly, during the year following cessation of mining in a given area, as a gradual fracturing and lowering of the overlying rocks. There would be no life or property hazards and thus no significant impacts. Chimney subsidence is more common to abandoned room-and-pillar mines and often results in the formation of hazardous sink holes at the ground surface. This type of subsidence is not likely to occur due to the No Action Alternative.

As part of the permit to mine, Arch would be responsible for developing a subsidence plan which would include detailed calculations concerning the amount of subsidence anticipated and a subsidence monitoring and mitigation plan. Impacts of subsidence on other resources are discussed in the following sections and are summarized as follows.

- Subsidence is not expected to affect air quality, noise/odor, or hazardous materials.
- Subsidence would permanently affect topography.
- Subsidence would affect mineral resources to the extent that future seismic exploration for oil and gas would be hindered by broken rock.
- Surface fractures could cause the loss of fossils and cultural resources.
- Local drainage patterns would be disrupted by the basins and ridges created by subsidence; Arch would be responsible for LOM interim and final maintenance of the overall drainage network in and adjacent to the CBCPA in accordance with LQD mine and reclamation plans.
- There may be slightly increased soil erosion from ridges into basins. Soil loss would occur primarily due to wind erosion. Wind and water erosion would eventually reduce the relief between ridges and basins. Soils would be locally affected if cracks develop at the surface. Arch would be responsible for prompt regrading and revegetation of this type of disturbance.
- Vegetation is not likely to be directly disturbed unless cracks form, and Arch would immediately revegetate such disturbances. Indirect impacts would occur because the basin and ridge topography would alter local soil moisture regimes, which would gradually affect species distribution. The tops of ridges would probably become too dry to support shrubs such as sagebrush. Spots that are lowered may receive more moisture which would enhance shrub growth or they may receive too much moisture thus stunting or precluding shrub growth but promoting lush herbaceous growth. The basin and ridge topography may also alter snow distribution and thus moisture accumulation patterns which could also cause gradual permanent changes to vegetation. Because this would be a slow and small-scale impact, no mitigation is recommended.
- Wildlife would be affected due to changes in vegetation, but the changes would be small-scale and thus not likely to cause any noticeable impacts. The low ridges could alter small-scale movement patterns but would not affect regional patterns. No mitigation is recommended.
- There is potential for wildlife or livestock to become injured in surface cracks. Again, Arch would monitor and promptly reclaim this type of surface disturbance.

Neither of the proposed power line corridors would be located in areas that have previously subsided or have potential for future subsidence.

Earthquake potential in the CBCPA is very low, so impacts from earthquakes would be unlikely. The power line routes cross ephemeral channels that may periodically experience flooding but there is little potential for flooding in the CBCPA. Known landslide areas in the NE of sec. 6, T.20 N., R.80 W., would be partially mined through and partially covered with spoil from the dragline and thus slope movement or failure is possible. During surface mining, a small portion (less than 10 acres) of the dune deposit in sec. 32, T.21 N., R.80 W., would be disturbed by spoil placement. This type of disturbance is not expected to activate the dune or cause accelerated soil loss. Power line route P-1 would not intersect any windblown deposits. P-2 would cross approximately 1 acre. Impacts due to geologic hazards would not likely be significant.

4.1.5.2 Proposed Action

Under the Proposed Action, there is potential for up to 7,322 acres of surface subsidence due to Archveyor™ plus underground mining (the acreage of surface lands that overlie the underground mine shown on Figure 2.9 plus a 400-ft buffer; see below). An estimated 257 acres would be slated for surface disturbance, so subsidence would create an additional 7,065 affected acres. There are two primary types of subsidence associated with underground mining, trough and chimney subsidence (Karafakis n.d.). Longwall mining techniques result in trough subsidence (Figure 4.7) wherein roof rocks are allowed to crumble immediately upon moving the longwall hydraulic support shields, and overlying rocks then settle onto collapsed roof rocks. Within the CBCPA, trough subsidence would occur as a gradual settling of rocks overlying mined-out longwall panels, and surface movement is expected to be imperceptible, occurring over a period of a year or more. At the surface, subsidence is anticipated to extend approximately 400 ft beyond the limits of the coal panels because the settling rock typically breaks at an angle, rather than straight to the surface (personal communication, February 1998, with Eldon Strid, Mine Engineers; Karafakis n.d.).

The surface would gradually settle 8.5-10.0 ft over all longwall panels during the year or more following mining (personal communication, February 1998, with Eldon Strid, Mine Engineers; Karafakis n.d.). Along the access entries between panels (i.e., the corridors that would be cut around coal panels), the surface would settle approximately 5 ft, so the area's topography would appear as 400- to 500-ft wide by 2-mi long basins (overlying the mined-out coal panels) that slope gently up to long, linear ridges (overlying the access entries). Subsidence would not occur over the east and south mains because they would be designed to last for the LOM and beyond, so material overlying the mains would stand out as small, linear rises approximately 8.5 to 10.0 ft higher than the surrounding landscape.

Chimney subsidence is not likely to occur due to the Proposed Action. Arch would be surface mining through approximately three abandoned underground mines but impacts due to subsidence, gas, and fires are not likely to occur because Arch would employ procedures that were proven at the Seminoe II Mine to protect life and property while the abandoned mines are mined through.

As part of the permit to mine, Arch would be responsible for developing a subsidence plan which would include detailed calculations concerning the amount of subsidence anticipated and a subsidence monitoring and mitigation plan. In addition to the impacts summarized for the No Action Alternative, subsidence from the underground mine would have the following effects.

- There may be slightly increased soil erosion from ridges into basins. Soil loss would occur primarily due to wind erosion. Wind and water erosion would eventually reduce the relief between ridges and basins.
- Indirect impacts would occur because the basin and ridge topography would alter local soil moisture regimes, which would gradually affect vegetation distribution. The tops of ridges would probably become too dry to support shrubs such as sagebrush. Spots that are lowered may receive more moisture which would enhance shrub growth or they may receive too much moisture thus stunting or precluding shrub growth but promoting lush herbaceous growth. The basin and ridge topography may also alter snow distribution and thus moisture accumulation patterns which could also cause gradual permanent changes to vegetation. Because this would be a slow and small-scale impact, no mitigation is recommended.
- Wildlife would be affected due to changes in vegetation, but the changes would be

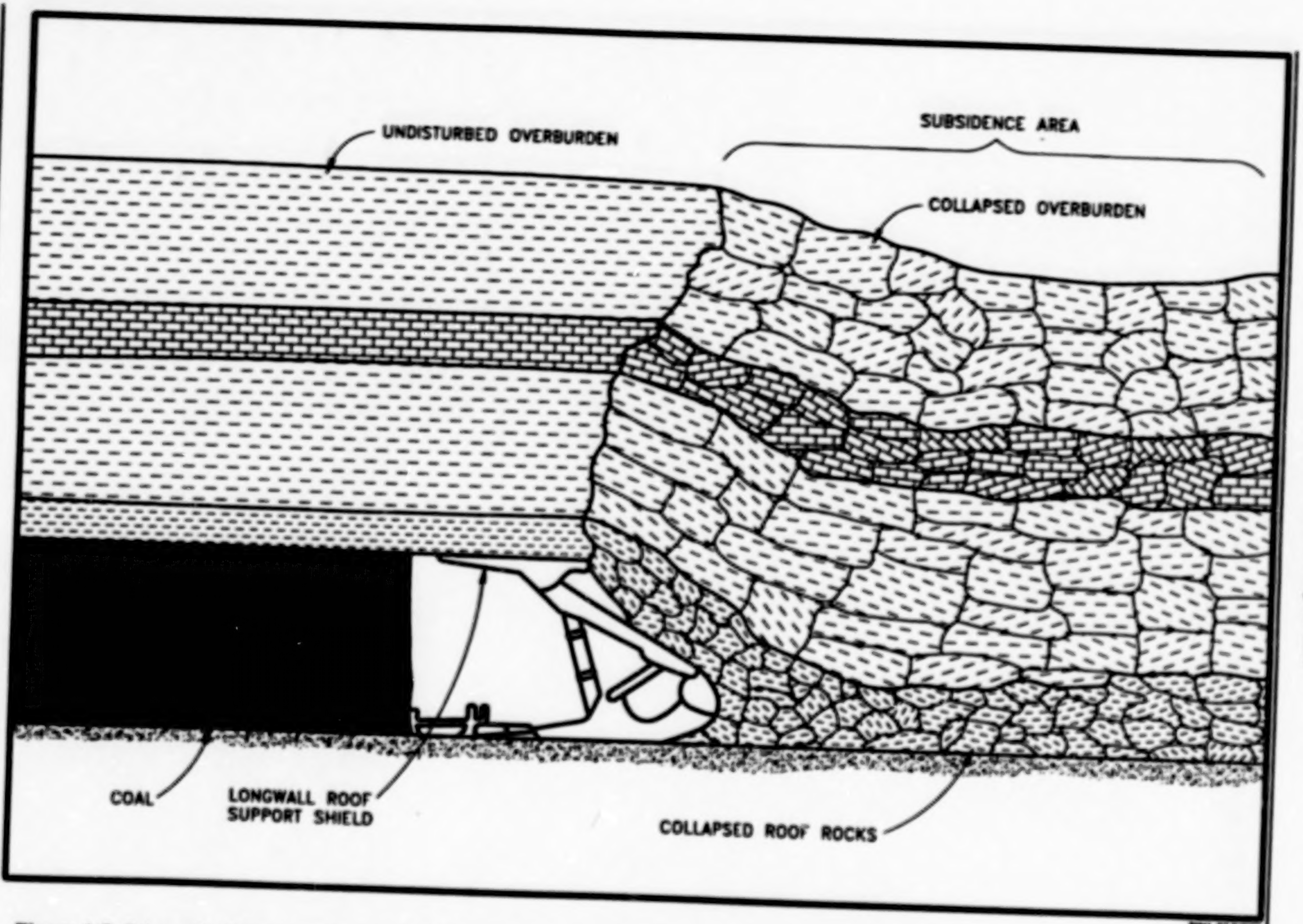

Figure 4.7 Schematic Diagram of Trough Subsidence Due to Longwall Mining (From Karafakis n.d.).

small-scale and thus not likely to cause any noticeable impacts. The low ridges could alter small-scale movement patterns but would not affect regional patterns. No mitigation is recommended.

Transportation Options 1, 2, and 3. Possible effects of geologic hazards on facilities related to transportation options 1 and 2 (haul road haulage from 2000 to 2005 followed by railroad haulage from 2005 to 2020) or 3 (LOM railroad haulage) would not be significant. The only additional concern specific to these options is that railroad corridors R1 and R2 would cross 93 and 80 acres, respectively, of windblown deposits. Neither of the railroad routes would cross subsidence, flood-prone, or landslide areas. Impacts would not be significant. Under transportation option 3, disturbance of windblown deposits due to railroad construction would occur in 1999 rather than in 2004.

Transportation Options 4, 5, and 6. These haul road routes B-1, B-2, and B-3 would traverse 0, 12, or 64 acres, respectively, of windblown deposits that would be susceptible to accelerated soil erosion once disturbed (1% of the disturbance area and thus not significant). None of the haul road routes would cross subsidence, flood-prone, or landslide areas. This additional disturbance would occur from 1999 to 2008. Between 80 and 93 acres of windblown deposits would be disturbed due to railroad construction in 2004. Impacts would not be significant.

Transportation Options 7 and 8. Conveyor corridor C-1 would intersect approximately 3.0 acres that may be prone to subsidence. Corridor C-2 would cross approximately 3.0 acres of windblown deposits that would be subject to accelerated erosion once disturbed (1999-2008). No landslides or flood-prone areas would be impacted by the two alternate conveyor routes. Between 80 and 93 acres of windblown deposits would be disturbed due to railroad construction. No significant impacts would occur.

Transportation Options 9 and 10. Haul road route D-1 follows existing roads that intersect 289 acres of windblown deposits. Conveyor route D-2 would cross approximately 17 acres of windblown deposits. No other geologic hazards are known to occur along routes D-1 and D-2 or in the Medicine Bow vicinity (i.e., the possible location of a new coal-handling facility). Disturbance would occur from 1999 to 2023. Impacts would not be significant.

4.1.5.3 Unavoidable Adverse Impacts

There would be no unavoidable adverse impacts, except the overall lowering of the landscape due to subsidence, caused by geologic hazards.

4.1.5.4 Cumulative Impacts

Cumulative effects from geologic hazards are not likely to be significant because preconstruction surveys for hazards would be conducted in all areas where hazards are likely, and hazards would either be avoided or projects would be engineered such that public safety and protection of natural resources objectives are met.

4.1.6 Paleontologic Resources

Federal, state, and/or county management objectives for paleontological resources are to maintain the integrity of the scientific value of paleontologic resources. The following analysis demonstrates that these objectives would be achieved under the No Action Alternative or the Proposed Action.

4.1.6.1 No Action Alternative

Under the No Action Alternative, approximately 3,270 acres of land with low paleontologic potential would be disturbed. Important paleontological resources on CBCPA (fossils of scientific significance) are not likely to be directly (i.e., destroyed due to mining or Archveyor subsidence) or indirectly (i.e., collected by unauthorized personnel) impacted by the project because there is low potential that important paleontological resources occur in the CBCPA. While the formations within the CBCPA are known to contain important fossils elsewhere in the Carbon and Hanna Basins, results of a field survey for fossils showed that there was little potential to encounter important fossils during mine development and operation (Winterfeld 1997); therefore, no significant impacts are anticipated.

Results of a Class I literature and database search suggest that there is potential to uncover important fossils along the power line corridors; thus, construction could result in the inadvertent destruction of scientifically important fossils. Routes P-1 and P-2 would cross 6.2 and <1.0 mi, respectively, of geologic formations with high paleontological potential (Table 4.9). All but five sections of the CBCPA have been field-surveyed; these sections, as well as the power line corridors, would be surveyed if they are included in the surface mine permit application. With mitigation and monitoring, the No Action Alternative is not likely to result in the loss or destruction of important fossils and could result in significant discoveries.

4.1.6.2 Proposed Action

Impacts to paleontological resources under the Proposed Action would be similar to those described for the No Action Alternative except that an additional 859 acres of land would be disturbed due to mining (a 26% increase), primarily due to the additional area to be surface-mined, and thus there is a greater potential for fossil loss (and conversely, fossil discovery).

With mitigation and monitoring, none of the transportation options are likely to significantly impact fossils. Mitigation and monitoring would be implemented, as needed, because a Class II literature and database search, completed for all transportation corridors (two railroads, four haul roads, and three conveyors), suggest the following.

- Significant fossils may occur along both railroad routes. Routes R-1 and R-2 would cross 7.4 and 1.9 miles, respectively, of geological formations with high paleontologic potential. Development of transportation options 1-8, all of which involve railroad construction, has potential to uncover significant fossils. Options 1, 2, and 3, for which additional construction would be limited to the railroad and possibly a coal-handling facility, would affect 1,077-1,263 acres (33-39%) more fossil-bearing land than the No Action Alternative.

- Significant fossils may occur along all three alternate haul road routes; thus there is potential for fossil discovery. Routes B-1, B-2, and B-3 cross 11.7, 5.8, and 16.0 mi, respectively, of formations with high potential to contain significant fossils. Thus, development of transportation options 4, 5, and 6 would affect 1,360-1,626 acres (42-50%) more than the No Action Alternative.

- Significant fossils may occur along both conveyor routes; thus there is potential for fossil discovery. Routes C-1 and C-2 would cross 9.8 and 9.4 mi, respectively, of formations with high potential to contain significant fossils. Compared with the No Action Alternative, these options (7 and 8) would affect an additional 1,160-1,178 acres (35-36%) of fossil-bearing formations.

- Significant fossils may occur along both the haul road (D-1) and conveyor (D-2) routes for transportation options 9 and 10; thus there is potential for fossil discovery. Routes D-1 and D-2 would each cross 6.2 mi of formations with high potential to contain significant fossils, although since D-1 would follow existing roads, new disturbance would be limited to that required to widen the roads. There are

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Table 4.9 Miles of Geologic Formations with High Paleontologic Potential Traversed Along the Alternate Transportation and Power Line Corridors.

Transportation Corridor	Geologic Units Traversed	Miles of High Paleontologic Potential Traversed
P-1	Hanna Formation, Medicine Bow Formation, Lewis Shale	6.2
P-2	Medicine Bow Formation, Lewis Shale, Mesaverde Group	<1.0
R-1	Medicine Bow Formation, Mesaverde Group, Steele Shale	7.4
R-2	Medicine Bow Formation, Lewis Shale, Mesaverde Group, Steele Shale	1.9
B-1	Hanna Formation, Ferris Formation, Medicine Bow Formation, Lewis Shale, Mesaverde Group	11.7
B-2	Hanna Formation, Lewis Shale, Mesaverde Group, Ferris Formation	5.8
B-3	Hanna Formation, Lewis Shale, Mesaverde Group, Ferris Formation, Medicine Bow Formation	16.0
C-1	Hanna Formation, Ferris Formation, Medicine Bow Formation, Lewis Shale, Mesaverde Group	9.8
C-2	Hanna Formation, Ferris Formation, Medicine Bow Formation, Lewis Shale	9.4
D-1	Hanna Formation, Ferris Formation, Medicine Bow Formation, Mesaverde Group	6.2
D-2	Hanna Formation, Medicine Bow Formation, Lewis Shale	6.2

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15 known localities in the vicinity of conveyor corridor D-2. Development of these transportation options would affect an additional 1,074-1,298 acres (33-40%) of fossil-bearing formations, compared with the No Action Alternative.

4.1.6.3 Unavoidable Adverse Impacts

Inadvertent loss of important paleontological resources would constitute an unavoidable adverse impact.

4.1.6.4 Cumulative Impacts

Cumulative impacts to paleontological resources would include the inadvertent loss or damage of important paleontological resources within the 33,963 acres that are disturbed or are proposed for disturbance within the CIAA (6% of the CIAA). Preconstruction surveys have been or would be completed on all disturbance areas with potential to yield important fossils, and mitigation and monitoring, commensurate with the potential for significant finds, would be implemented on all federally approved actions. While there would be unavoidable loss of some fossils, the potential for loss of important fossils would be low, and there would be potential for fossil discovery during preconstruction surveys. Cumulative impacts would not likely be significant.

4.1.7 Soils

The federal, state, and/or county management decisions concerning soils are:

- to maintain soil cover and productivity where they are adequate,
- to increase soil cover and productivity where they are in a downward trend,
- to control flood and sediment damage from natural or human-induced causes, and
- to protect the land from soil erosion.

The following analysis demonstrates that these management objectives would be achieved under the No Action Alternative and the Proposed Action.

As part of the mine permit application, Arch would be required to prepare a detailed soil handling plan (e.g., amount to be salvaged by soil type, locations and volumes of topsoil stockpiles, topsoil stockpile protection measures) and a detailed soil replacement and reclamation plan, including specific soil treatments needed to restore productivity. Because soils would be protected for the LOM and productivity would be restored during reclamation, impacts to soils under the No Action Alternative and the Proposed Action would not be significant.

4.1.7.1 No Action Alternative

Mine development and operation would directly impact 3,270 acres within the CBCPA and along the power line corridors. Under the No Action Alternative, the following soil impacts are anticipated:

- soil mixing would cause homogenization of soil physical and chemical properties;
- soil removal and stockpiling would cause disruption of soil biology;
- wind and water erosion would cause permanent soil loss;
- sensitive (e.g., saline, calcareous) soils would be difficult to reclaim; and
- soil compaction would cause decreased productivity.

Other possible effects include accidental spill of hazardous materials which could cause soil contamination.

Mixing of Physical and Chemical Properties. The overall mixing of physical and chemical soil properties is an unavoidable impact but is not likely to affect soil productivity. Post-reclamation soils would be much more uniform in texture, structure, depth, color, organic matter content, and chemical composition, as well as other physical and chemical properties compared with premining soils. These effects would be long-term,

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continuing well beyond the LOM until these characteristics are reestablished via soil development through natural processes. Replaced soils are expected to support the proposed postmining land uses.

Disruption of Soil Biology. Impacts to soil biological functions would be short-term (and generally not noticeable) for topsoil that is directly backhauled and long-term (and somewhat noticeable) for soils that are stockpiled. Short-term impacts would include major disruption of soil biologic activity, but little mortality or loss of organic matter. Long-term impacts would include a reduction in soil organic matter and mortality of microbial populations, seeds, bulbs, and live plant parts.

Soil Loss Via Wind and Water Erosion. Soils with severe erosion potential are widespread within the CBCPA and along the power line corridors. Under the No Action Alternative, approximately 3,270 acres would be directly disturbed and thus exposed to potential for accelerated soil loss via erosion. Most of this disturbance would occur within the ridge-rockland landscape type where all soils have high wind and water erosion hazards. Soil loss and the potential for maintaining long-term productivity would depend on site-specific conditions, but with the effective implementation of the mitigations required for the mine permit, loss would be minimal and long-term productivity would not be affected.

Reclamation of Sensitive Soils. Certain soils would be more difficult to reclaim due to chemical or physical limitations, including but not limited to steep slopes, salinity, alkalinity, high proportions of rock fragments, and high clay content. Most soils within the CBCPA meet LQD requirements for suitable topsoil, so these limitations are expected to be minimal. Because soils would be mixed during salvage, the poor soil characteristics would be diluted by better quality soils, and thus no special soil handling or reclamation procedures would be necessary. In addition, topsoil replacement depth (an average of 12 inches) may be greater than premine soil depths in certain areas, and thus could enhance reclamation and revegetation efforts, especially on areas such as ridge-rocklands.

Soil Compaction. During topsoil replacement, soils would be compacted due to heavy equipment traffic. Compaction decreases the volume of air and water in the soil profile, which would result in a short-term decrease in productivity.

Possible Contamination Due to Spills of Hazardous Materials. No significant adverse impacts due to accidental spills of petroleum products, discharged mine-water, or other pollutants are expected because hazardous materials would be properly contained, facilities would be located away from drainage areas, and Arch would adhere to approved spill prevention, control, and countermeasures plans.

4.1.7.2 Proposed Action

Under the Proposed Action, soils impacts would be 859 acres (26%) greater than for the No Action Alternative due to the additional area disturbed during surface mining. Impacts would be similar to those described for the No Action Alternative except that underground mine subsidence may cause surface cracks which would affect soils in localized areas, although they would be promptly reclaimed. Furthermore, the basin and ridge topography created by subsidence would cause accelerated erosion from ridges into the basins, which would eventually reduce the relief between ridges and basins, and overall soil loss would be minimal.

Transportation Options 1-3. Additional surface mining and railroad and possible coal-handling facility construction would result in an additional 1,077-1,236 acres (33-39%) of soil disturbance compared with the No Action Alternative. No significant impacts are expected.

Transportation Options 4-6. Development of a haul road option would cause an additional

1,360-1,626 acres (42-50%) of soil disturbance, primarily due to additional surface mining and haul road and railroad construction. Assuming that the 200-ft wide disturbance created during construction would be reclaimed to a width of 150 ft for the 5-year period of hauling coal, 473 acres would remain disturbed until the haul road is reclaimed in 2006-2008. It is anticipated that the portions of routes B-2 and B-3 that would be constructed along existing roads may be reclaimed to local road standards (i.e., a 20-ft travelway, crowned-and-ditched, with culverts and other standard drainage features, depending on landowner preferences) such that haul road construction and subsequent reclamation would result in long-term road improvement. Since route B-1 parallels Highway 72, the haul road would be completely reclaimed once the railroad is operational.

Transportation Options 7-8. Implementation of the conveyor options would create an additional 1,160-1,178 acres (35-36%) of disturbance, compared with the No Action Alternative due to additional surface mining and conveyor and railroad construction. A large fraction of this disturbance would remain until the railroad is operational in 2005. Regardless of the route selected, the conveyor would be completely disassembled but the access road may be left in place as directed by the landowners. Thus short-term soil impacts would be increased by up to 1,178 acres (36% higher than for the No Action Alternative) but no long-term effects on productivity are expected, and no significant impacts would occur.

Transportation Options 9-10. Implementation of the no railroad transportation options would create an additional 1,074-1,298 more acres (33-40%) of disturbance, depending, in part, on whether a conveyor or haul road would be constructed. Conveyor construction would result in less disturbance. The railroad would not be constructed, thus avoiding up to 256 acres of disturbance. Haul road/conveyor and coal-handling facility construction would begin in 1999, and a large fraction (over half) of the disturbance would remain for the LOM. Impacts would not be significant.

4.1.7.3 Unavoidable Adverse Impacts

Unavoidable adverse impacts to soils would include soil loss due to wind and water erosion and short- to long-term loss of productivity in some soils due to vegetation removal, soil exposure and compaction, mixing of soil horizons, and temporary reduction or loss of biological activity.

4.1.7.4 Cumulative Impacts

Existing and proposed disturbances in the CIAA have or would affect approximately 33,963 acres of soil (6% of the CIAA). The greatest impact would be soil loss due to erosion, because soils in the region are prone to wind and water erosion once disturbed. The other impacts described for the No Action Alternative and the Proposed Action would also occur due to the various developments in the CIAA, so there is and would continue to be a region-wide temporary loss of soil productivity. However, given that this is a multiple land use area, and soils are supporting and will continue to support multiple land uses including wildlife habitat, livestock grazing, recreation, coal mining, mineral/oil and gas development, etc., in acceptable proportions, cumulative effects on soils are not significant.

All federally approved projects and LQD-permitted mines are required to monitor soil erosion and vegetative productivity on reclaimed lands and to ensure that soils are stable and productive prior to bond release. Thus, the major developments in the CIAA are and would be monitored such that cumulative impacts would be adequately revealed.

4.1.8 Surface Water and Groundwater

The federal, state, and/or county management objectives for water resources are to:

- protect surface and groundwater resources from degradation;
- maintain riparian areas in good or excellent condition and to improve riparian areas that are in fair or poor condition;
- control flood and sediment damage from natural or human-induced causes;
- meet or exceed established standards for quality of surface water and groundwater where water quality has been lowered by human-induced causes;
- provide for physical and legal availability of water for use by the public and by federal, state, and local agencies for fisheries and wildlife and for livestock, recreational, municipal, and industrial uses; and
- to promote water conservation, quality, and optimum use of water resources.

In addition, surface waters within the North Platte watershed must be managed to comply with USFWS rules for the protection of T&E fish species--rules that govern the amounts of allowable depletions in the river system.

The following analysis shows that none of these objectives would be violated by the No Action Alternative or the Proposed Action.

4.1.8.1 Surface Water

As part of the permit to mine, Arch would be required to prepare a detailed surface water protection plan which would include provisions for diversions, sediment ponds, channel modifications and restorations, and surface water monitoring. Channel and drainage restoration plans would be included in the LQD-approved reclamation plan. Therefore, no significant surface water impacts are anticipated.

No Action Alternative. Potential direct impacts to surface water due to mine development and operation (including power line construction) would include:

- potential decreases in water quality,
- minor surface water loss,
- drainage/watershed alterations, and
- possible contamination due to spills of hazardous materials.

Indirect impacts would occur due to topographic alterations--an overall flattening of the landscape over surface-mined areas which would result in:

- reduced runoff rates,
- increased infiltration,
- minor reductions in peak flows,
- possible decreased erosion,
- possible increased vegetative productivity,
- possible accelerated groundwater recharge, and
- possible minor reductions in the volume of water that reaches the Medicine Bow River.

The No Action Alternative would result in 624 acres (8.0% of total acreage in the Second Sand Creek watershed) of new disturbance within the Second Sand Creek watershed, 1,844 acres (26.7%) in the Third Sand Creek watershed, and approximately 760 acres (12.6%) within the Southern Closed Basin (Table 4.10). An additional 41 acres proposed for disturbance by mining in the southeastern CBCPA (sec. 11 and 12, T.20 N., R.80 W.) is drained by the Medicine Bow River. In watersheds outside of the CBCPA, power line construction would result in 8-30 acres of disturbance initially and zero acres for the LOM and is not expected to impact any surface waters.

Potential Decreases in Water Quality. Water quality impacts, resulting from increased sedimentation in stream channels and ponds and increased turbidity and salinity of surface waters due to runoff and erosion from disturbed areas, are expected to be minimal because surface water control measures would be implemented for the LOM. These surface water quality impacts would not be significant.

The proposed project is not likely to impact water quality in the Medicine Bow River since state and federal regulations require that all surface runoff

Table 4.10 Acreage of Watershed Disturbance Within the CBCPA, No Action Alternative and Proposed Action.

Watershed	Total Acreage	Proposed Disturbance Acreage, No Action Alternative	Proposed Disturbance Acreage, Proposed Action (Excluding Transportation Corridors)
Second Sand Creek[1]	7,699	624	652
Third Sand Creek[1]	6,911	1,844	2,046
South Closed Basin	6,010	760	1,227
Medicine Bow River	937,818	41	44
Sevenmile Lake Basin	528	>1	137
Total	955,966	3,270	4,107

[1] Acreage upstream from the eastern project area boundary.

from mined lands pass through sedimentation ponds, and water quality must meet certain standards before it is discharged per NPDES. Water released from private/state coal mining sedimentation ponds would likely be of better quality than natural runoff in ephemeral streams because sediments would be removed during retention. Thus, a smaller volume of sediment would be delivered to the Medicine Bow River via Second and Third Sand Creeks during surface mine operations than either before or after mining. The potential for sediment pond failure (and subsequent release of a large quantity of sediments) during the LOM is estimated to be less than 5% (BLM 1997a), whereas the potential for the natural landscape to release a similarly large quantity of sediment (e.g., during a storm) is estimated to be 30-40% (BLM 1979). Water quality in the Medicine Bow River would not be significantly impacted.

After surface mine reclamation, the landscape would be slightly flatter and runoff rates would thus be somewhat reduced (see Section 4.1.5.1). Infiltration rates would likely increase resulting in imperceptibly lower volumes of surface runoff and reductions in peak flows.

Surface Water Loss. Surface water loss via infiltration or evaporation could result from continuous changes in discharge and runoff patterns due to the relocation of diversions and the alteration and reconstruction of drainage channels as mining progresses. Under the No Action Alternative, Arch would construct approximately 13 sediment ponds with a total surface area of 12.9 acres and 93.28 acre-ft of storage. Assuming that evaporation rates would average 45 inches annually (Martner 1986), an estimated 35 acre-ft per year of surface water would be lost via evaporation which is 0.027% of the average annual flow in the Medicine Bow River. Because this is a small proportion of the total flow in the regional system, no downstream users would be impacted by this loss. Furthermore, excess groundwater from coal seam dewatering would be piped to sediment ponds and eventually discharged to the surface system, thereby reducing or perhaps compensating for evaporation losses. As part of the permit to mine, Arch would be required to monitor both surface and groundwater quantities so these impacts would be precisely defined and mitigated per LQD requirements. Mitigation for depletions is discussed in Section 5.1.13.

Mine development and operation disturbances within the CBCPA would result in the loss of eight stock watering facilities. Additionally, one privately held irrigation diversion right (25 acres in NWSW of sec. 32, T.21 N., R.80 W.) for 0.35 cfs could be affected. If water rights are affected, Arch would be responsible for obtaining permits to develop wells or other sources to supply the right-holders with the permitted quantity of water of equal or better quality. Thus, impacts to surface water users would not be significant.

Drainage/Watershed Alterations. Temporary disturbance of the Second and Third Sand Creek watersheds could cause changes in channel elevation and gradient which may result in headcutting (e.g., channel erosion that progresses upstream). The degree of headcutting that could occur would be dependent on precipitation, streamflow, and soil cohesion, and while headcutting is a natural geomorphic adjustment process, stream channel disturbance and alteration of the natural flow regime may result in watershed-wide adjustments (e.g., incised channels, sedimentation). Headcutting would cause increased sedimentation in stream channels.

Possible Contamination Due to Spills of Hazardous Materials. No adverse impacts due to accidental spills of petroleum products, discharged mine water, or other pollutants are expected because hazardous materials would be properly contained; facilities would be located away from drainage areas; and Arch would adhere to approved SPCC Plans and 401 Permits for stream crossings.

Indirect Effects. Indirect effects would occur due to topographic changes. The overall lowering of the landscape due to coal removal and possible subsidence over Archveyor™ pits would reduce runoff rates which, in turn, would increase infiltration rates, reduce peak flow rates, possibly increase vegetative productivity because of moister soils, and possibly increase groundwater recharge. Because water would tend to stay in the area longer, there probably would be minor reductions in the volume of water that reaches the Medicine Bow River.

Proposed Action. Under the Proposed Action, impacts would be similar to those described for the No Action Alternative except that a larger area would be surface-mined, and there would be potential for subsidence over an area of approximately 7,322 acres (see Section 4.1.5.1). Direct surface disturbance would be up to 4,107 acres. An additional 7,065 acres (over and above the 4,107 acres disturbed by mining) could be affected due to subsidence. Total impacts in the mine area (7,322 acres) would be 41% higher than for the No Action Alternative. The duration would be 11 years longer.

Within the CBCPA, the Proposed Action (excluding transportation corridors) would affect 652 acres (8.0%) within the Second Sand Creek watershed, 2,046 acres (29.6%) within the Third Sand Creek watershed, 1,227 acres (20.4%) of the South Closed Basin watershed, 44 acres (<0.1%) of the Medicine Bow River watershed, and 137 acres (25.9%) of the Sevenmile Lake Basin (Table 4.10). Effects due to subsidence of the underground mine would affect the First and Second Sand Creek watersheds by causing an overall lowering of the landscape. Impacts would not be significant.

Transportation Options 1-3. Under these options, impacts to surface water would be similar to those described for the No Action Alternative except that an additional 1,077-1,263 acres would be disturbed (a 33-39% increase), primarily due to the additional disturbance resulting from surface-mining and railroad and possible coal-handling facility construction. These actions would minimally increase the potential for surface water quality impairment because surface water and sediment controls would be used according to the WDEQ mining plan. No surface water use would be required for these options, and thus no additional adverse impacts to surface water quantity or surface water users are anticipated. Total surface disturbance under these options would be 4,347-4,533 acres (Table 2.1). The railroad would minimally affect First and Second Sand Creeks and Chapman Draw. Impacts would not be significant.

Transportation Options 4, 5, and 6. Development of any of the haul road options would create an additional 1,360-1,626 acres (42-50%) of new disturbance (depending on the route selected), and thus the potential for surface water impairment (e.g., sedimentation, turbidity and/or salinity) would increase. Since the proposed haul road routes cross several streams and springs (Jim Creek, Standpipe Draw, Carbon Creek, First Sand Creek, Percy Creek), potential impacts to surface water quality would occur in watersheds located outside the CBCPA. If portions of the haul road are left in place, there would be potential for permanent wind and water erosion from the road's surface, but it is not likely to cause noticeable surface water quality affects. No surface water use would be required for this alternative, and thus no additional adverse impacts to surface water quantity or surface water users are anticipated. Impacts would not be significant.

Transportation Options 7 and 8. Development of the conveyor options would result in an additional 1,160-1,178 acres (35-36%) of new disturbance. Thus there would be increased potential for stream sedimentation and other effects on water quality because a larger area would be surface-mined and a conveyor and railroad would be constructed; other surface water impacts would be similar to those described for the No Action Alternative (not significant). The proposed conveyor routes cross several streams that occur outside the CBCPA (Jim Creek, Percy Creek, First Sand Creek, and Carbon Creek), thereby minimally increasing the potential for localized decreases in water quality. Following conveyor and access road reclamation, impacts would be reduced to just those associated with railroad operation and maintenance, which would be minimal. If the access road is left in place after the conveyor is removed, there would be a permanent increase in potential wind and water erosion, but surface water quality is not likely to be noticeably affected by erosion from the road. No surface water use would be required for this alternative, and thus no additional adverse impacts to surface water quantity or surface water users are anticipated.

Transportation Options 9 and 10. Under the no railroad option, surface disturbance would be 1,074-1,298 acres greater than for the No Action Alternative, so potential for adverse surface water quality impacts due to runoff and erosion would be greater, but other impacts would be similar (not significant). Chapman Draw is the only stream outside of the CBCPA that would be affected by haul road or conveyor construction. No additional surface water use would be needed so impacts to water quantity and water users would be the same as for the No Action Alternative.

Unavoidable Adverse Impacts. There would be an unavoidable increase in surface disturbance in watersheds within and adjacent to the CBCPA and surface water loss due to channel and diversion modifications and evaporation from sediment ponds.

Cumulative Impacts. New disturbances within the CBCPA over the LOM would add to the 21,252 acres already disturbed by mining in the CIAA. A total of 33,963 acres within the CIAA (6% of the total CIAA area) has been or could be affected by development, and numerous streams, wetlands, riparian areas, springs, ponds, reservoirs, and watersheds would be impacted. Current and future land uses including grazing; recreation (hunting, fishing, off-highway vehicles); windpower generation; mineral, oil, and gas extraction; and ROW development (e.g., power lines, pipelines, and roads) contribute and would contribute to an overall decline in surface water quality, may result in surface water consumption or loss through evaporation, and could affect the rights of surface water users. All federally approved developments would comply with federal, state, and local laws such that surface water quality and quantity in and adjacent to the CIAA remain suitable for multiple uses including recreational contact, support of cold water fisheries and T&E fish species, livestock and wildlife watering, irrigation, and industrial consumption in acceptable proportions. Measurable adverse impacts to Seminoe Reservoir and the North Platte River (e.g., increased sediment loads, impaired water quality, restricted recreational access due to water quality/quantity problems) from cumulative developments in the CIAA would be avoided. Depletions would be acceptable but only if they comply with USFWS rules regarding depletions in the North Platte River system.

For all federally approved developments, mitigation would include, but is not necessarily limited to:

- avoiding surface waterbodies, where feasible;
- minimizing disturbance;
- using water conservation techniques to reduce the amount of surface water consumed (e.g., maintaining irrigation systems such that no unnecessary consumption occurs);
- proper management of all wastes (e.g., spoils, petroleum products, solid and human wastes, hazardous materials) in accordance with federal, state, and local laws;
- including drainage control structures/ procedures in all plans for surface disturbance (i.e., development and implementation of stormwater pollution prevention plans);
- monitoring and maintaining drainage control structures/procedures to ensure that surface water quantity and quality is preserved within acceptable levels; and
- reclaiming all disturbed areas that are not required for continued operations.

As part of the LQD mine permit, coal mines are required to establish a monitoring network for surface water and groundwater to ensure that mitigation procedures are meeting objectives to minimize impacts to water quality and quantity and to water right holders (see Chapter 5.0). Furthermore, all developments that would disturb over 5 acres are similarly constrained, through the state's NPDES permit, to implement an Stormwater Pollution Prevention Plan (SPPP) to minimize impacts to surface water. Livestock grazing, wildlife movements, and on- and off-road vehicle impacts on surface and groundwater are not specifically monitored, but the major streams and aquifers used for domestic consumption, fisheries (including T&E fish), irrigation, and livestock uses are periodically tested to ensure that water quality and quantity continue to support these uses. Thus, monitoring is adequate to reveal cumulative impacts.

4.1.8.2 Groundwater

No Action Alternative. Impacts to groundwater within the Carbon Basin would include:

- direct groundwater consumption at a rate of up to 26,000 gallons per day;
- indirect groundwater loss due to evaporation;
- temporary loss and permanent alteration of coal and overburden aquifers due to mining and Archveyor™ subsidence;
- direct impacts to groundwater users due to groundwater consumption and drawdown in areas adjacent to the proposed mines;
- possible very long-term (thousands of years) reduction in groundwater quality in the replaced overburden aquifer or overburden that is broken during Archveyor™ subsidence; and
- accidental temporary pollution caused by unwanted discharges to groundwater.

These effects are discussed in more detail below and would be evaluated in specific detail in the mine permit applications. Groundwater quantity, quality, and use outside the basin would not be affected by the No Action Alternative because the basin is essentially closed with respect to

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groundwater movement and power line construction and operation is not expected to impact groundwater.

Direct Groundwater Consumption. The surface mine would require approximately 26,000 gallons of water per day (Table 2.6); 8,000-9,000 gallons would be obtained from coal seam dewatering and thus would directly affect water quantity in the coal aquifer. The Seminoe II loadout is currently supplied in part by a well owned by Arch and in part by the Hanna municipal source, although the proportion of water provided by each source is unknown (personal communication, June 1998, with Cathy Wick, Arch). The loadout currently consumes approximately 15,000 gallons per day, and these levels would continue for the new mines. The direct consumption of 26,000 gallons of groundwater per day under the No Action Alternative would be a permanent impact but not significant because groundwater sources would be adequate to supply the required volume and aquifers would eventually recharge.

Indirect Groundwater Consumption. During coal seam dewatering, groundwater would be lost through evaporation. The quantity of in-flowing water is likely to exceed that needed for dust suppression, so surplus water would be pumped to sediment ponds where evaporation would also result in indirect groundwater losses. However, it is possible that excess groundwater in sediment ponds would offset the loss of surface water due to evaporation, and thus USFWS-required mitigation for surface water depletions would not be necessary.

Aquifer Removal and Disruption. Approximately 3,270 acres of coal and overburden aquifers would be removed and/or broken during mining and Archveyor™ subsidence. Undisturbed portions of these aquifers would recharge via new and existing pathways and would supply water for dust suppression for the LOM. In mined-out areas, replaced overburden would be composed of a nonhomogeneous mixture of clay- to gravel-sized grains and would eventually fill with water and become an aquifer whose permeability would probably be higher than that of the premine aquifer. Overburden that is replaced by a dragline would be loosely compacted, and the coarsest grains tend to roll downhill and form a layer of coarse rubble; the resulting aquifer would be relatively permeable (in the range of 450 gallons per day per square foot [gallons/day/ft²]) (Rahn 1976) with a zone of higher permeability at the base. Overburden material that is emplaced by trucks, bulldozers, and/or scrapers would be more compacted and thus would have lower permeability (e.g., 4 gallons/day/ft²) (Rahn 1976).

Premine aquifer permeability from 13 wells at the Seminoe II Mine ranged from 0.2 to 260 gallons/day/ft², although most permeability values were less than 20 gallons/day/ft². Permeability in nine wells in replaced overburden aquifers at Seminoe II ranged from 0.4 to 24 gallons/day/ft². All but one of these had permeabilities between 0.4 and 4.0 gallons/day/ft², which is in the range predicted for spoils replaced using trucks, shovels, and scrapers. Overburden geology would have a substantial effect on the permeability of postmine aquifers and thus the Seminoe II data are not directly representative of what might occur in the CBCPA, but the geologic formations are similar (predominantly Hanna Formation shale, sandy shale, sandstone, siltstone, and coal). Given that existing data show aquifer permeabilities ranging from 0.015 to 0.808 gallons/day/ft², it is likely that postmine aquifer permeabilities would be greater than premine, but because there are very few site-specific data, the magnitude of the change in permeability cannot presently be predicted. Since the basin is closed, permeability changes would not impact regional groundwater systems regardless of magnitude. Changes in permeability are also not expected to impact streamflow because groundwater elevations are apparently well below stream elevations (personal communication, February 1998, with Daryl Jensen, Western Water Consultants, Inc).

Archveyor™ subsidence would cause overburden to fracture, which would probably permanently increase aquifer permeability, depending on the degree of fracturing. Fractures are typically productive aquifers because water can move more quickly through cracks than through porous rock. The potential degree of fracturing would be determined as part of the subsidence monitoring plan required by LQD. Impacts including changes in permeability and groundwater quality would occur locally, but because the basin is closed, no regional effects are anticipated.

Drawdown Effects on Groundwater Users. Drawdown of the coal aquifer would occur throughout the LOM during coal seam dewatering but is not likely to adversely affect groundwater systems outside of the CBCPA because the basin is hydrologically closed. If, during baseline studies for the mine permit application, it is determined that drawdown would affect water availability in the one stock-watering well within the CBCPA, the owner/user would be provided with an alternate equal or better water source. The 42 other wells within or adjacent to the CBCPA are monitoring wells owned by Arch or Nuclear Energy Resources, Inc. Thus, no LOM impacts to groundwater users due to drawdown are expected.

After reclamation, aquifers would recharge, although the recharge rate would depend on the characteristics of the replaced aquifer, and it may require 100 years or more for postmine groundwater levels to recharge to premine levels (BLM 1997c). However, water levels within the replaced overburden aquifer may be sufficiently recovered within a few years of final reclamation such that landowners/lessees could construct productive wells for stockwatering. Thus, impacts due to drawdown would last for many years beyond the LOM but would not be permanent.

No overburden dewatering is anticipated, so fracturing of aquifers that overlie the Archveyor™ pits could enhance recharge of these relatively dry beds and create a productive aquifer where none had previously existed. Again, the degree and extent of aquifer creation due to Archveyor™ subsidence would depend on the degree of fracturing. Archveyor™ subsidence would not diminish potential for recharge unless existing fractures or recharge pathways are disrupted and comparable new pathways are not created.

Long-Term Reduction in Groundwater Quality. Groundwater quality in the postmine overburden and subsidence aquifers would likely contain higher levels of calcium, sulfate, magnesium, manganese, and TDS than premining waters because infiltrating water would flow across relatively fresh-cut rock faces where newly exposed minerals would be readily dissolved (Rahn 1976; Van Voast 1978). TDS in the postmine aquifers would probably be higher than the premining range of 1,690-2,170 milligrams/liter (mg/l) (overburden aquifer) and 672-7,104 mg/l (coal aquifer). Premine groundwater quality is poor, suitable only for livestock and wildlife watering and industrial uses, and since no water flows out of the Carbon Basin, it is likely that postmining groundwater quality would remain poor, probably permanently.

Although the potential TDS increase cannot be quantified based on existing data, postmining TDS levels could occasionally (or in certain locations) exceed levels that are considered healthy for livestock (up to 12,000 mg/l) (Wyoming Department of Agriculture n.d.). However, surface sources provide most water for livestock and wildlife in the CBCPA, so adequate water for livestock and wildlife would be available.

Of the 43 wells within and adjacent to the CBCPA, 42 are monitoring wells installed by coal companies or other industry, and though they would be mined through or otherwise impacted by the No Action Alternative, their intended use would be fulfilled and thus there would be no impacts to these users. One well permitted for stockwatering could be disrupted due to mining. If this well is affected, Arch would provide the permittee with an alternative source of equal or better quantity and quality.

Proposed Action. Impacts to groundwater under the Proposed Action would be similar to those described for the No Action Alternative except that direct groundwater consumption would be almost five times greater and more aquifers would be disrupted due to subsidence over the underground mine. The mines would require approximately 123,000-126,000 gallons of water per day; 109,000 gallons would be obtained from coal seam dewatering and thus would directly affect water quality in the coal aquifer. An estimated 14,000 gallons would be provided by a new well constructed in the CBCPA to supply water for the new coal-handling facility. The location of the new well has not been determined, but the well would be located outside the disturbance area and completed in an aquifer below the Lewis Shale.

The Cloverly Formation, which occurs deep below the Lewis Shale, is considered a major aquifer in the area, with artesian groundwater that could supply up to 150 gallons per minute (216,000 gallons per day) (Richard et al. 1981), which would be more than adequate to supply the 14,000 gallons per day required by the new coal-handling facility. Arch will test several formations for adequate water quantity and quality prior to completing the well.

The direct consumption of 123,000-126,000 gallons (97,000-100,000 gallons more than for the No Action Alternative) of groundwater per day under the Proposed Action would be a permanent impact but not significant because groundwater sources would be adequate to supply the required volume and aquifers would eventually recharge.

Overburden, coal removal, and subsidence would affect an estimated 7,322 acres of aquifers, 41% more than for the No Action Alternative, and aquifers would be affected to a depth of approximately 800 ft. Since the Lewis Shale aquitard (an impermeable layer) underlies the Hanna Formation, aquifers below the Lewis Shale would not be affected. The duration of impact would be 11 years longer than for the No Action Alternative.

Transportation Options 1-3. Development of transportation options 1 and 2 (over-the-road haulage from 2000 to 2005 followed by railroad haulage from 2005 to 2020) or 3 (LOM railroad haulage), in conjunction with the Proposed Action, would require consumption of up to 126,000 gallons per day of groundwater, 100,000 gallons more than would be required under the No Action Alternative. Transportation option 3 would require groundwater to supply the new coal-handling facility in 1999 instead of in 2004. In addition, the municipal source and Arch's existing well at Hanna would not be tapped for 15,000 gallons per day for the Seminoe II loadout, and the new coal-handling facility would consume 1,000 fewer gallons per day than the Seminoe II loadout. Other impacts (indirect groundwater consumption, temporary loss and permanent alteration of the aquifers, impacts to groundwater users, reduction in groundwater quality, and potential for pollution from accidental spills) would be similar to the No Action Alternative.

Transportation Options 4, 5, and 6. Options 4-6 (haul road haulage from 2000 to 2005 followed by railroad haulage from 2005 to 2020) would require an additional 8,000-9,000 gallons per day for dust suppression on the haul road and 1,000-2,000 gallons per day for equipment washing from 2000 to 2005, a 42% increase over that required for the No Action Alternative during this period. From 2005 to 2020, and additional 100,000 gallons would be required for underground mining equipment (a 284% increase over the No Action Alternative). Coal seam dewatering is expected to supply sufficient water for dust suppression and underground mining equipment operations, so this additional consumption probably would not be noticeable.

Transportation Options 7 and 8. The conveyor haulage (2000-2005) followed by railroad haulage

(2005-2020) would require an additional 3,000-4,000 gallons per day for dust suppression along the conveyor access road from 1999 to 2005 (a 15% increase over-and-above the No Action Alternative during this period). An additional 100,000 gallons per day would be required for underground mining equipment (a 284% increase). Coal seam dewatering is expected to supply sufficient water for dust suppression and underground mining equipment operations, so this additional consumption probably would not be noticeable.

Transportation Options 9 and 10. The no railroad options would result in consumption of approximately 14,000 gallons per day from a source near Medicine Bow--either from the Medicine Bow municipal supply or from a new well--to operate a new coal-handling facility. The Seminoe II loadout, which consumes approximately 15,000 gallons per day, would not be used, so these options would save 1,000 gallons per day during 2000-2007, but would consume an addition 15,500 gallons per day from 2007 to 2020. The municipal source is sufficiently underutilized that it could supply this amount without affecting Medicine Bow's current users. If a new well is constructed, it would be completed such that the 14,000 gallon/day drawdown would not affect other permitted users. An additional 3,000-10,000 gallons/day would be required for dust suppression along the haul road or conveyor access road from 2000 to 2020 (a 38% increase over the No Action Alternative), and an additional 100,000 gallons per day would be needed for underground mining equipment (a 284% increase). Coal-seam dewatering is expected to provide sufficient water for dust suppression so this additional consumption would not likely be noticeable.

Unavoidable Adverse Impacts. Between 26,000 and 126,000 gallons of groundwater per day would be consumed due to mining. Transportation would require an additional 3,000-10,000 gallons per day. Coal and overburden aquifers would be permanently altered, and groundwater quality within the CBCPA would be impaired for the LOM and beyond.

Cumulative Impacts. Because the Carbon Basin is relatively isolated from adjacent aquifers, cumulative groundwater effects would be limited to groundwater consumption at Hanna and at the new coal-handling facility (14,000-15,000 gallons per day). The existing mines are closing--17,646 acres of the 21,252 acres disturbed have been reclaimed, and monitoring wells show that groundwater recharge is already in progress. With time, groundwater recharge in reclaimed areas would more than offset the additional consumption created by the new mines so cumulative effects may show an increase in groundwater availability. Cumulative groundwater quality effects would be as described for the No Action Alternative. Aquifers underlying 21,252 acres that have been disturbed by mining will likely contain poor quality groundwater well into the future, and the proposed project would add 7,322 acres to this effect, but other aquifers are available to supply good-quality groundwater (Richter 1981; Lowry et al. 1973; Daddow 1986). Consequently, groundwater uses (domestic, industrial, irrigation, wildlife and livestock watering, etc.) would not be affected by existing, proposed, and reasonably foreseeable future development in the CIAA.

As part of the LQD mine permit, coal mines are required to establish a monitoring network for surface and groundwater to ensure that mitigation procedures are meeting objectives to minimize impacts to water quality and quantity and to water right holders. Furthermore, all developments that would disturb over 5 acres are similarly constrained, through the state's NPDES permit, to implement an SPPP to minimize impacts to surface water. Livestock grazing, wildlife movements, and on- and off-road vehicle impacts on surface and groundwater are not specifically monitored, but the major streams and aquifers used for domestic consumption, fisheries (including T&E fish), irrigation, and livestock uses are periodically tested to ensure that water quality and quantity

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continue to support these uses. Thus, monitoring is adequate to reveal cumulative impacts.

4.1.9 Alluvial Valley Floors

No alluvial valley floors occur within the CBCPA (BLM 1997a:Appendix 1-13; personal communication, February 1998, with Jim Nyenhuis, Soil Scientist), and none are known to occur along any of the alternate transportation corridors. Since Second and Third Sand Creeks would be avoided (except for the dragline walk road, which would be constructed to preserve existing flows), overall surface runoff patterns would be maintained for the LOM, and because groundwater in the CBCPA is hydrologically separated from the Medicine Bow River, mine development and operation would not affect its associated alluvial valley floors. Thus, the No Action Alternative and the Proposed Action are not expected to have direct, indirect, or cumulative effects on alluvial valley floors. No mitigation or monitoring is recommended.

4.1.10 Noise and Odor

There are no federal, state, and/or county management objectives for noise or odor. Compliance with MSHA rules, potential loss of hearing, or increased noise levels that would adversely affect local residents' ability to sleep or perform daily tasks are primary concerns for noise management within the CBCPA and along the transportation corridors. The analyses presented below show that the No Action Alternative and the Proposed Action would be consistent with these objectives.

4.1.10.1 Noise

No Action Alternative. Noise levels within and adjacent to the CBCPA would increase substantially due to equipment operation (e.g., dragline, scrapers, haul trucks, conveyors) and blasting. The *Noise Control Act of 1972* suggests that noise levels below 70 dBA do not cause hearing loss in humans, and levels below 55 dBA, in general, do not cause adverse impacts. In a report for the Caballo Rojo Mine in the Powder River Basin, OSM determined that noise levels from crushers and conveyors would not exceed 45 dBA at a distance of 1,500 ft. Noise created by blasting would be approximately 123 dBA at the blast site and 40 dBA approximately 1,230 ft from the blast. Truck and heavy construction equipment generate noise levels of 85-88 dBA at a distance of 50 ft (Cunniff 1997). Equipment operation would occur 24 hrs/day for the LOM and would affect anyone near the mine or near a haul route. Blasting would occur only during daylight hours.

There are two residences and a Conoco Station within 1.0 mi of the CBCPA, the nearest of which is approximately 0.5 mi (2,640 ft) south of the CBCPA (see Figure 1.3). Thus, all residences and the Conoco Station are beyond the range where blasting noise dissipates to below 40 dBA (i.e., below ambient levels of 55 dBA). The residences are sufficiently distant from the mine area such that noise from heavy equipment traffic is not likely to be heard, and they are not located along any of the proposed haul routes, so would not be affected by noise from haul trucks. The Conoco Station would be affected by noise from traffic including heavy trucks on route to the mine, and given the expected increase in traffic, the increased noise levels would be notable to station employees and patrons but would not be loud or persistent enough to cause hearing loss because the station is approximately 1 mi from the haul route.

Noise would also be generated by increased traffic, especially haul truck traffic, on area roadways. Motorists on Highways 72 and 30/287 would be subject to haul truck noise at regular intervals while they are travelling on the haul route (12-15 minutes). Haul trucks would not be heard in Hanna. Elmo residents may occasionally hear a low rumble from haul trucks on the Hanna Bypass which would be annoying or distracting to certain people at certain times, especially at night. Haul truck noise levels (85-88 dBA at 50 ft) would

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dissipate to below 55 dBA by the time it travels the 660 ft to the limits of Elmo.

Recreationists in the mine vicinity would hear operations and would likely be annoyed by the noise but not impaired by it. Noise impacts on wildlife are discussed in Section 4.2.2.

With mitigation and monitoring, mine operations would be in compliance with MSHA rules, and no loss of hearing or impacts that would affect the ability of local residents to sleep or perform daily tasks would occur; thus, no significant impacts would occur due to noise. Noise impacts would occur for 12 years.

Proposed Action. Noise impacts under the Proposed Action would be similar to those described for the No Action Alternative, except that impacts would occur for an additional 11 years (although they would be much reduced after the surface mine closes) and there would be additional impacts due to construction and operation of the various transportation options.

Transportation Options 1 and 2. Under transportation options 1 and 2, noise associated with over-the-road haul truck traffic would cease in 2005, when the railroad would become operational; thus from 2005 to 2007, over-the-highway noise would be much reduced compared with the No Action Alternative. Impacts would occur for an additional 11 years but would not be significant. Noise would also be generated during railroad construction and by trains. Residents of Medicine Bow would be affected by temporary increased noise levels during construction and noise from two trains per day (one round trip) during operations from 2005 to 2020, but since train traffic commonly occurs in this area, noise from the train would be similar to ambient noises and would not cause significant effects. There are no occupied residences along either of the railroad routes.

Transportation Option 3. Implementation of option 3 (LOM railroad haulage) would virtually eliminate noise associated with over-the-road haulage from 2000 to 2007. Noise from railroad construction and operations would be as described for options 1 and 2 and would constitute a LOM increase in noise levels along the railroad corridors. Impacts would occur for an additional 11 years but would not be significant.

Transportation Options 4-8. Under the haul road and conveyor options, noise from over-the-road haul trucks would be virtually eliminated and thus much lower than for the Proposed Action. Additional noise would occur due to haul road or conveyor construction and operation. However, there are no residences along any of the haul road or conveyor routes, so the primary receptors would be recreationists and wildlife. Elmo residents may occasionally hear a low rumble caused by 200-ton haul truck traffic that would be similar to but less frequent than the over-the-road haul truck noise. Railroad-related noise would be as described for transportation option 1. Impacts would occur for an additional 11 years but are not expected to be significant.

Transportation Options 9 and 10. Under the no railroad transportation options (LOM haul road or conveyor), noise from over-the-road haul truck traffic would be eliminated (except for trips to serve local customers), and thus lower than for the No Action Alternative. Haul road or conveyor and coal-handling facility construction and operation would cause increased noise levels at Medicine Bow and could affect recreationists or other receptors that happen to be along the transportation corridor. Arch would locate the new coal-handling facility and haul road or conveyor sufficiently distant from Medicine Bow so that it would not be heard or only rarely heard at residences or business. Haul truck or conveyor noise which would be a more continuous rumble for people who are out-of-doors. Impacts would occur for an additional 11 years, but would not be significant.

Unavoidable Adverse Impacts. Elevated noise levels in the mine vicinity and along the transportation corridors under the No Action Alternative and the Proposed Action would constitute an unavoidable adverse impact.

Cumulative Impacts. Noise from the CBCPA, coupled with noise from the SeaWest Wind Plant development in the Simpson Ridge area, would cause widespread noise increases in what is currently a rural setting. However, noise would dissipate quickly, so no health or lifestyle impacts are expected. These projects may also overlap with local oil and gas or other mineral extraction developments which would have cumulative noise effects, but they are not expected to be significant. There would be no overlap with other developments in the CIAA, so additional cumulative effects are not anticipated.

4.1.10.2 Odor

No Action Alternative. Mine development and operation would result in increased odors from exhaust and dust for the LOM. Mine employees would be directly affected by the increased odors. None of the residents adjacent to the CBCPA, in Elmo, or in Medicine Bow or employees or patrons of the Conoco Station would be affected because all of these locations are 660 ft or more away from mine facilities, and odors are expected to dissipate before reaching them. Increased odors at the mine site and along Highway 72 would occur for 12 years. Impacts would not be significant.

Proposed Action and Transportation Options. Under the Proposed Action and all transportation options, mine employees would be exposed to odors from exhaust and dust as described for the No Action Alternative. The duration of impact would be approximately 11 years longer. No significant impacts are anticipated.

Unavoidable Adverse Impacts. All of the alternatives would result in some additional odors within and adjacent to the CBCPA and transportation corridors but odors likely would be quickly dispersed by the wind.

Cumulative Impacts. The SeaWest Wind Plant would not contribute to increased odors except during construction, and other developments within the CIAA are not sufficiently close to the CBCPA to cause cumulative odor impacts, so no significant cumulative effects would occur.

4.1.11 Electric and Magnetic Fields

Neither the BLM, the state, or the county have management plans specific to electric and magnetic fields. Because there are no residences in or adjacent to the CBCPA that would be exposed to electric and magnetic fields from the permanent or temporary power lines, electric and magnetic fields would not cause impacts under the No Action Alternative or the Proposed Action. Furthermore, the 115-kV power line is not expected to cause television or radio interference.

4.2 BIOLOGICAL RESOURCES

4.2.1 Vegetation

There are no federal, state, and/or county management objectives specifically for vegetation. For the purposes of this analysis, land use and soils objectives were applied to vegetation. The following analysis demonstrates that the No Action Alternative and the Proposed Action would be compatible with these objectives.

As part of the permit to mine, Arch would be required to prepare a detailed reclamation plan which would include procedures for establishing self-sustaining plant communities and standards for revegetation success. Arch would be required to post a reclamation bond which would not be released until revegetation success standards have been met. Thus, no significant impacts to vegetation would occur under the No Action Alternative or the Proposed Action. Impacts to vegetation as it relates to wildlife habitat are discussed in Section 4.2.2.

4.2.1.1 Plant Communities

No Action Alternative. Impacts to vegetation would include vegetation removal, long-term changes in species composition and diversity and long-term conversion of shrublands to grasslands while reclaimed areas are reestablishing, loss of forage for wildlife and livestock, wildlife habitat loss, and possible weed infestations.

The No Action Alternative would result in up to 3,270 acres of vegetation removal within the CBCPA and along the power line corridor (Table 4.11). Interim reclamation would occur concurrently with mining (see Table 2.3) so the disturbance acreage would vary over the LOM; by the year 2012 all disturbed areas would be reclaimed.

An estimated 1,729 acres of the sagebrush shrubland vegetation community (15% of the total acreage of this type within the CBCPA) would be disturbed during the LOM (see Table 4.11). Power line construction outside the CBCPA would remove an additional 19 acres of this type. Approximately 1,364 acres of mixed shrub/rough breaks, bottomland shrub, grass/subshrub, and bottomland grassland communities would also be impacted.

Long-term effect on species composition and diversity and long-term conversion of shrublands to grasslands are unavoidable adverse effects that would occur wherever vegetation is removed. Initially, reclaimed lands would be dominated by grasses; fewer species would be present so diversity would be lower than premine diversity. A diverse, productive, and permanent vegetative cover, capable of supporting proposed postmining land uses, would likely be established within approximately 10 years following reclamation (BLM 1997a), depending on climate, soils, grazing pressure, and other factors affecting reclamation success. Productivity may be higher on newly reclaimed areas because grasses and forbs produce biomass more quickly than shrubs. Arch would be required by WDEQ to restore at least one shrub per square meter over 20% of the area disturbed and demonstrate that shrub communities are self-sustaining prior to bond release. This standard would support the anticipated postmining land uses of grazing land and wildlife habitat. Additional measures may be required by WDEQ to reestablish crucial winter range (see Section 4.2.2). Restoration of sagebrush to premining levels would take an estimated 20-100 years (BLM 1997a).

Proposed Action and Transportation Options. Under the Proposed Action and all transportation options, impacts to vegetation would be the same as those identified for the No Action Alternative (not significant), although more vegetation would be removed, the timing of disturbance would vary depending on the transportation options developed, and final reclamation would occur in 2023--although the majority of reclamation would be completed with closure of the surface mine. The Proposed Action would result in a 26% (837 acres) increase in vegetation removal over the No Action Alternative. The Proposed Action plus the transportation options would cause additional effects ranging from 33 to 50% (1,077-1,626 acres) more disturbance than for the No Action Alternative. Assuming that vegetation types would be disturbed in approximately the same proportions as for the No Action Alternative, sagebrush shrubland would be the mostly heavily impacted over the LOM.

Unavoidable Adverse Impacts. The No Action Alternative and the Proposed Action would result in vegetation removal from the CBCPA and transportation corridors, long-term effects on species composition and diversity, and long-term conversion of shrublands to grasslands and would provide favorable habitat for weed invasion.

Cumulative Impacts. A total of 33,963 acres of vegetation within the CIAA (6% of the CIAA area) has been/would be removed due to past, existing, proposed, and reasonably foreseeable development. The primary measures for reducing cumulative impacts would be successful

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Table 4.11 Estimated Disturbance Area of Vegetation Types Within the CBCPA.

Vegetation Community	Premine Vegetation Composition (acres)	% of CBCPA (premine)[1]	No Action Alternative		Proposed Action		Transportation Corridors (Options 1-8)
			Acres In[2]	Acres Out[3]	Acres In[2]	Acres Out[3]	Acres Out[3]
Sagebrush shrubland	11,867	65	1,729	19	2,191	19	165
Mixed shrub/ rough breaks	3,508	19	1,050	6	1,332	6	49
Bottomland shrub	1,346	7	200	2	254	2	19
Grass/subshrub	865	5	101	1	128	1	12
Mine reclamation	241	1	81	<1	104	<1	3
Disturbed land	159	1	71	<1	89	<1	2
Greasewood flat	117	1	0	<1	0	<1	2
Hay meadow	80	<1	0	<1	0	<1	1
Playa	69	<1	3	<1	4	<1	1
Pipeline reclamation	61	<1	0	<1	0	<1	1
Bottomland grassland	22	<1	4	0	5	0	<1
Cottonwood bottom	17	<1	0	0	0	0	<1
Reservoir/ stockpond	8	<1	1	0	2	0	<1
Total	18,360	100	3,240	30	4,107	30	256

Table 4.11 (Continued)

Vegetation Community	Premine Vegetation Composition (acres)	% of CBCPA (premine)[1]	Affected %	Haul Road Corridors (Options 4, 5, and 6)	Conveyor Corridors (Options 7 and 8)	No Railroad Option (Options 9 and 10)
				Acres Out[3]	Acres Out[3]	Acres Out[3]
Sagebrush shrubland	11,867	65	53	508	221	297
Mixed shrub/ rough breaks	3,508	19	32	151	64	88
Bottomland shrub	1,346	7	6	57	25	34
Grass/subshrub	865	5	3	38	17	22
Mine reclamation	241	1	3	11	5	6
Disturbed land	159	1	2	7	3	4
Greasewood flat	117	1	0	5	2	3
Hay meadow	80	<1	0	4	2	2
Playa	69	<1	<1	3	1	2
Pipeline reclamation	61	<1	0	3	1	2
Bottomland grassland	22	<1	<1	1	<1	<1
Cottonwood bottom	17	<1	0	1	<1	1
Reservoir/ stockpond	8	<1	<1	<1	<1	<1
Total	18,360	100	100	789	341	461

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[1] Vegetation disturbance in permit area was calculated on % affected (Intermountain Resources 1997).

[2] In = within the CBCPA

[3] Out = outside the CBCPA along transportation and power line corridors and including disturbance from a new coal-handling facility for Options 3, 9, and 10. Numbers are from the largest corridor within each group.

revegetation with adapted native plant species, but there would be a long-term shift from shrublands to grasslands due to the time required for a successful shrub establishment. However, once self-sustaining plant communities have established, post-development land use, productivity, species diversity, ground cover, wildlife habitat, and weed control would be reestablished, and cumulative effects would not be considered significant.

4.2.1.2 Wetlands

As part of the permit to mine, jurisdictional wetland delineations would be completed in all areas to be disturbed. Arch would be required to develop a wetland mitigation plan, in consultation with WDEQ and the U.S. Army Corps of Engineers (ACE), which would be implemented during final reclamation such that wetlands would be restored acre-for-acre (or more) and wetland values and functions (i.e., hydrologic and ecologic characteristics) would be similar to premine conditions. Therefore, impacts to wetlands would not be significant.

No Action Alternative. Under the No Action Alternative, mining would cause the direct loss of approximately four potential wetlands for a total of approximately 2 acres. Because Arch would leave a 100-ft buffer where mining would occur around Second and Third Sand Creeks, wetlands associated with these creeks would not be impacted (Table 4.12).

Wetlands associated with springs or other groundwater discharge points could be adversely affected due to aquifer dewatering, and it is possible that surface water diversions could impact wetlands if a surface water source for wetlands is diverted away. If the indirect effects of groundwater loss impacted every potential wetland in the CBCPA (i.e., all of those that were not directly disturbed by mining), up to 136 acres of wetlands would be lost until aquifers recharge or the hydrologic regime is otherwise restored. Indirect wetland losses would be monitored during the LOM, and the acreage, values, and functions of these wetlands would be restored as required by WDEQ and the ACE.

Impacts caused by wetland disturbance would include loss of:

- important biological sites for food chain production; wildlife habitat; and nesting, rearing, and resting sites for aquatic and land species;
- natural storm and floodwater storage areas;
- groundwater recharge and discharge areas;
- wildlife watering areas;
- water purification sites; and
- natural sedimentation and salt deposition sites.

Proposed Action. As with the No Action Alternative, the Proposed Action would result in direct disturbance of approximately 2 acres of potential wetlands within the CBCPA. Disturbance associated with the transportation options would range from 0.0 to 7.0 acres (Table 4.12) (although impacts could be reduced by relocating a particular transportation corridor to avoid wetlands).

Subsidence could indirectly impact wetlands, and effects may be beneficial or adverse. Creation of the basin and ridge topography over subsidence areas would alter drainage patterns and could create, enhance, or diminish wetlands. Because there would be an overall lowering of the landscape, depressions would likely develop so that standing water could lead to the creation of wetlands. Altered groundwater patterns caused by overburden fracturing during subsidence could affect water sources for existing wetlands, the results of which would depend on whether more or less water is supplied to a given wetland. Arch would be required to restore presubsidence drainage patterns according to a WDEQ-approved subsidence monitoring plan, and Arch and WDEQ would consider the potential for wetland creation/enhancement, as well as mitigation for wetland loss due to subsidence, as part of the plan.

Table 4.12 Estimated Acreage of Wetland Disturbance, No Action Alternative and Proposed Action.

Disturbance Area	Acres of Wetlands Disturbed	
	No Action Alternative	Proposed Action
CBCPA	2.0	2.0
P-1	0.0	0.0
P-2	0.0	0.0
R-1	0.0	0.0
R-2	0.0	6.3
B-1	0.0	2.0
B-2	0.0	7.0
B-3	0.0	3.0
C-1	0.0	<1.0
C-2	0.0	1.4
D-1	0.0	<1.0
D-2	0.0	<1.0
Coal-handling facility[1]	0.0	0.0

[1] Since location of the coal-handling facility is not yet known, it is possible that its construction would impact wetlands, but it would be sited to avoid wetlands, if possible.

Under the transportation options 1, 2, and 3, up to 6.3 additional acres of wetlands would be disturbed due to railroad construction. Under option 3 (which involves coal-handling facility construction in a previously undisturbed area), additional wetlands could be impacted. If feasible, the coal-handling facility would be located to avoid wetlands; if avoidance is not feasible, an unknown but likely small amount of wetlands would be lost. The impacted wetlands would be included in the wetland mitigation plan and thus options 1-3 would not likely result in permanent wetland loss or significant impacts.

Impacts to wetlands under options 4-6 would not be significant, although additional wetlands could be impacted during haul road construction. Additional wetland disturbance would range from 2.0 acres for route B-1 to 7.0 acres for route B-2, plus up to 6.3 additional acres due to railroad construction.

Under transportation options 7 and 8, up to 1.4 and 6.3 additional acres, respectively, of wetlands could be impacted by conveyor/access road and railroad construction. Route C-1 would pass within 0.25 mi of Percy Spring area, but the spring is not likely to be impacted. Wetlands associated with Percy Creek would be avoided, if feasible, but if they cannot be avoided, less than 1 acre of potential wetlands would be impacted. Route C-2 would follow along the eastern side of First Sand Creek for approximately 1.5 mi and would cross the creek several times; if wetlands in this area cannot be avoided, approximately 1.4 acres of wetlands would be disturbed (see Table 4.12). These options would not significantly impact wetlands.

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With the development of transportation options 9 and 10, less than 1.0 acre would be disturbed by construction of the coal-handling facility and haul road or conveyor. Since there are few wetlands in the Medicine Bow vicinity, it is likely that the coal-handling facility can be located to avoid wetlands. East Allen Lake and other potential wetland areas occur adjacent to but not along the proposed haul route (D-1) or conveyor route (D-2); therefore, these two options are is not likely to impact wetlands or would impact less than 1.0 acre above-and-beyond the 2 acres affected by mining within the CBCPA.

Maximum disturbance of wetlands would occur under transportation option 5 (haul road route B-2) where up to 7.0 acres of wetlands would be disturbed (350% more than for the No Action Alternative). The Proposed Action and transportation option 3 (assuming development of railroad route R-1) would result in no incremental increase in direct wetlands effects; although indirect effects (over-and-above those described for the No Action Alternative) due to subsidence would occur.

Unavoidable Adverse Impacts. The No Action Alternative and the Proposed Action would result in long-term and possibly permanent loss of wetlands and wetland values and functions; however, wetlands would be replaced on an acre-for-acre (or more) basis.

Cumulative Impacts. It is likely that past disturbances in the CIAA have resulted in permanent wetland loss since many developments occurred prior to enactment of the *Clean Water Act* (1972) and issuance of Executive Order 11990, Protection of Wetlands (1977), and because small losses are permissible under current regulations. Current laws mandate that wetland delineations be conducted on all areas proposed for disturbance, and the ACE has the authority to require mitigation for any and all wetland loss, but makes the determination on a case-by-case basis. Proposed and reasonably foreseeable future development could result in small amounts of wetland loss, but for any project (including the proposed mine development) that would affect more than a few acres of wetlands, the ACE would likely require mitigation including acre-for-acre wetland restoration and the re-creation of wetland values and functions. Since the mitigation requirements are determined on a case-by-case basis, it is not possible to quantify the expected cumulative net loss, if any, of wetlands within the CIAA, but because the ACE manages wetlands for "no net loss" as mandated by Executive Order 11990, very little, if any, cumulative loss is anticipated, and cumulative impacts would not be significant.

4.2.2 Wildlife and Fisheries

Federal, state, and/or county management objectives for wildlife are as follows:

- to provide habitat quality (food, cover, space, and water) adequate to support a natural diversity of wildlife and fisheries, including big game; upland game; waterfowl; non-game species; game fish; sensitive, threatened, and endangered species; and species of special management interest in Wyoming and to assist in meeting goals of recovery plans;
- to maintain or improve vegetation conditions and/or avoid long-term disturbance in high-priority standard habitat sites and fisheries areas; and
- to maintain or improve overall ecological quality of moderate- and low-priority standard habitat sites, thus providing good wildlife habitat within the constraints of multiple-use management.

Specific management objectives identified in the GDRA RMP (BLM 1990), the Wyoming State Land Use Plan (Wyoming State Land Use Commission 1979), the Carbon County Land Inventory (UW 1991), and the Carbon County Land Use Plan (Pedersen 1997) for resources that would be affected by the No Action Alternative or the Proposed Action include the following.

- Raptor Concentration Areas. To manage resources within raptor concentration areas so that productivity of nesting raptor pairs is maintained while allowing for development of coal and oil and gas and to seek the cooperation of owners of adjacent property in management of raptor nesting habitat.

- Crucial Winter Range. To protect crucial winter ranges for all big game species, to mitigate surface disturbance by restoring or replacing habitat, and to reclaim previously depleted habitat in big game crucial winter ranges to the extent possible.

  In areas where crucial winter ranges for more than one species of big game overlap, management objectives include assuring that habitat quality is maintained, reclaiming previously depleted habitat to the extent possible, and employing spatial and temporal management of development, facilities, and users to avoid activity in sensitive areas or during sensitive times of the year.

- Sage Grouse Strutting Grounds and Nesting Habitat. To protect sage grouse strutting grounds and nesting habitat.

The following analysis shows that the No Action Alternative would result in long-term temporary loss of pronghorn and mule deer crucial winter ranges, overlapping crucial winter ranges, sage grouse breeding and nesting/wintering habitat, and mountain plover habitat and would constitute significant impacts at the local area where habitat is removed but should not have a significant impact at the regional population level. The Proposed Action, with appropriate mitigation, would incrementally increase the acreage of disturbance; however, it would be consistent with management objectives for crucial winter range, overlapping crucial winter ranges, and sage grouse breeding habitat and for providing and maintaining quality habitat for mountain plover.

4.2.2.1 No Action Alternative

Impacts to wildlife would occur from direct loss of habitat associated with the surface mine and construction of facilities, power lines, and access roads. The degree of these impacts would be magnified where habitats of special significance (e.g., breeding, nesting, or fawning areas; crucial winter range) are disturbed. Many species of wildlife (e.g., big game, predators, birds) would be displaced from areas proposed for disturbance during at least a portion of the LOM; whereas small mammals, reptiles, amphibians, and other species with small home ranges would experience direct mortality associated with habitat disturbance. Wildlife mortality also is likely as a result of vehicle/animal collisions due to increased traffic within and adjacent to the CBCPA, poaching and harassment associated with increased access in the area, or abandonment of eggs or young as a result of human activity and/or disturbance.

Pronghorn. Potential impacts to pronghorn as a result of the No Action Alternative may be direct (e.g., collision with vehicles as a result of increased traffic in the area) and/or indirect (e.g., disturbance to or displacement from habitat, including crucial winter range). Ninety-five percent (17,367 acres) of the CBCPA is pronghorn crucial winter range. The No Action Alternative (mine and power line) would result in a maximum disturbance of 3,270 acres of pronghorn crucial winter range (Table 4.13), including disturbance to the northeastern portion of the CBCPA, where 63% of the winter pronghorn observations were recorded during 1997 surveys (Intermountain Resources 1997). The 3,270 acres of crucial winter range disturbed represents 19% of the pronghorn crucial winter range within the CBCPA and approximately 0.7% of the crucial winter range in the Medicine Bow Herd Unit. Up to 1,523 acres would be disturbed at any one time [see Table 2.3]); Arch has demonstrated the ability

Table 4.13 Potential Disturbance to Big Game.[1,2]

	Pronghorn[4]			Mule Deer[4]			Elk[4]
Proposed Disturbance[2]	CW	WYL	SSF	CWYL	WYL	YL	WYL
Surface Mine							
No Action (3,240 acres)[3]	3,240	–	–	1,642	1,598	–	3,270
Proposed Action[5] (4,107 acres)	4,107	–	–	1,700	2,377	–	4,107
Increase in disturbance acreage (%) due to Proposed Action	859 (26)	–	–	58 (4)	779 (49)	–	859 (26)
Power lines							
P1 (8 acres)	8	–	–	8	–	–	8
P2 (30 acres)	30	–	–	–	30	–	30
Railroads							
R1 (240 acres)	240	–	–	–	256	–	256
R2 (256 acres)	218	38	–	–	240	–	240
Coal-handling facilities[6]							
CBCPA (170 acres)	170	–	–	170	–	–	–
Medicine Bow (170 acres)	170	–	–	–	–	170	–
Haul roads							
B1 (267 acres)	–	267	–	–	222	45	222
B2 (388 acres)	81	245	62	–	341	47	341
B3 (533 acres)	85	384	64	–	341	192	341
D1 (291)	291	–	–	–	–	–	291
Conveyors							
C1 (67 acres)	–	67	–	–	56	11	56
C2 (85 acres)	23	51	11	–	70	15	70
D2 (67 acres)	67	–	–	–	67	–	67

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[1] No white-tailed deer designated habitat is proposed for disturbance.

[2] See Figures 2.4-2.6 and 2.8 for the locations of each transportation corridor. The No Action Alternative would include either P1 or P2. The Proposed Action would include either P1 or P2 and either R1 or R2 and one or more of the other transportation corridors.

[3] Total disturbance acreage associated with the area is provided in parentheses.

[4] CW = crucial winter range; WYL = winter/yearlong range; SSF = spring/summer/fall range; CWYL = crucial winter/yearlong range; YL = yearlong range.

[5] Mine-related disturbances; does not include transportation options, includes power lines.

[6] Exact location unknown; based on estimated location.

to reestablish shrubs on reclaimed areas on their existing Hanna Basin Mine (Intermountain Resources 1996); however, the shrub cover important to pronghorn (e.g., sagebrush) would take 20-100 years to reestablish (BLM 1997a), and impacts to pronghorn crucial winter range would continue until sufficient and suitable vegetation was reestablished. Pronghorn use reclaimed areas on the existing mines in the Hanna Basin (annual wildlife monitoring reports for Seminoe I, Seminoe II, Medicine Bow, and Edison Development Company Mines on file with WDEQ) and are expected to return to previously disturbed areas on the CBCPA when they are revegetated.

In addition to direct habitat loss, pronghorn may be displaced from crucial winter range immediately adjacent to disturbed areas as a result of increased human presence, noise, and physical barriers (e.g., fences, conveyors, mine facilities). This displacement would result in an additional unquantified loss of habitat (particularly crucial winter range). However, pronghorn habituate to activities that are repetitious as long as they are not harassed, and individuals appear to acclimate to large trucks and other vehicles on active mines near Hanna as long as the vehicles appear in routine, predictable patterns and humans remain in the vehicles so the displacement is reduced after a habituation period.

Displacement from areas adjacent to disturbance may result in use of marginal habitat or the overuse and degradation of areas of increased use. Currently, the pronghorn population in the Medicine Bow Herd Unit is approximately 44% below WGFD objective and is exhibiting little to no growth as a result of depressed fawn production (personal communication, August 12, 1997, with Bob Lanka, Wildlife Management Coordinator, WGFD, Laramie). If efforts to achieve WGFD objectives are successful, increased pronghorn grazing pressure may be placed on the remaining crucial winter range in the CBCPA. This impact may be reduced by ensuring that big game movement in the area is not impeded; however, some degree of impact to adjacent crucial winter range and/or local pronghorn populations is unavoidable. The proposed mine is located in the tip of a large crucial winter range and, given the mobility of pronghorn, the mine is not likely to significantly affect seasonal movements through the herd unit. The anticipated level of disturbance of the No Action Alternative in pronghorn crucial winter range constitutes a significant impact in the areas where the habitat is removed, but the proposed removal of approximately 0.7% of the crucial winter range for the Medicine Bow herd should not have a significant impact at the population level, given the current low population, the numerous other factors that influence the Medicine Bow herd, and the requirements for reclamation. It will, however, reduce the potential population if or when crucial winter range is the main factor controlling the population. Direct mortality due to vehicle collisions is not expected to be a significant impact on pronghorn.

Mule Deer. Potential impacts to mule deer as a result of the No Action Alternative may be direct (e.g., collision with vehicles as a result of increased traffic in the area) and/or indirect (e.g., disturbance to or displacement from habitat, including crucial winter range). Approximately 25% (4,647 acres) of the CBCPA is mule deer crucial winter/yearlong range. The No Action Alternative (mine and power line) would result in a maximum disturbance of 3,270 acres (up to 1,650 acres of mule deer crucial winter/yearlong range and 1,628 acres of winter/yearlong range) depending on the power line route selected (see Table 4.13). The 1,650 acres of crucial winter range disturbed represents 35.3% of the mule deer crucial winter range in the CBCPA and slightly over 1% of crucial winter range within the Sheep Mountain Herd Unit. Up to 1,523 acres would be disturbed at any one time [see Table 2.3]); Arch has demonstrated the ability to reestablish shrubs on reclaimed areas on their existing Hanna Basin mines (Intermountain Resources 1996); however, the shrub cover that is important to mule deer during winter (e.g., sagebrush) would take

20-100 years to reestablish (BLM 1997a), and the impacts to mule deer crucial winter range would continue until sufficient and suitable vegetation was reestablished. Mule deer use reclaimed areas on existing mines in the Hanna Basin (annual wildlife monitoring reports for Seminoe I, Seminoe II, Medicine Bow, and Edison Development Company Mines on file with WDEQ) and are expected to return to previously disturbed areas.

In addition to direct habitat loss, mule deer may be displaced from crucial winter/yearlong range and winter/yearlong range immediately adjacent to disturbed areas as a result of increased human presence, noise, and physical barriers (e.g., fences, conveyors, mine facilities). This displacement would result in an additional unquantified loss of habitat (particularly crucial winter/yearlong range). However, mule deer habituate to activities that are repetitive and predictable as long as they are not harassed and individuals appear to acclimate to large trucks and equipment on active mines near Hanna as long as the vehicles operate in routine, predictable patterns and humans remain in the vehicles so displacement is reduced after a habituation period.

Displacement from areas adjacent to disturbance may result in use of marginal habitat or the overuse and degradation of areas of increased use. Currently, mule deer populations in the Sheep Mountain Herd Unit are approximately 20-30% below WGFD objective and are exhibiting slow growth as a result of depressed fawn production (personal communication, August 12, 1997, with Bob Lanka, Wildlife Management Coordinator, WGFD, Laramie). If efforts to achieve WGFD objectives are successful, increased mule deer grazing pressure may be placed on the remaining crucial winter/yearlong and winter/yearlong ranges in the CBCPA. This impact may be reduced by ensuring that big game movement in the area is not impeded; however, some degree of impact to adjacent crucial winter range and/or local mule deer populations is unavoidable. The proposed mine is located on the north edge of the crucial winter range with movement into the area from the south, so the mine is not likely to significantly affect seasonal movements through the herd unit. The anticipated level of disturbance of the No Action Alternative in mule deer crucial winter range constitutes a significant impact in areas where habitat is removed, but temporary removal of approximately 1% of the crucial winter range for the Sheep Mountain herd should not have a significant impact at the population level given the current low population in the herd. It will, however, reduce the potential population if crucial winter range is the main factor controlling the population. Direct mortality due to collision with vehicles is not expected to be a significant impact on mule deer.

The 1,650 acres of mule deer crucial winter range is also considered pronghorn crucial winter range so the No Action Alternative would result in disturbance of 1,650 acres of overlapping crucial winter range. This habitat loss would constitute a significant impact in local areas where habitat is removed and would remain significant during the period of active mining and until the disturbed area is reclaimed. Pronghorns and mule deer will use the reclaimed areas after they are revegetated, but the overall effects to the populations cannot be isolated because of the numerous other factors that are affecting the maintenance or growth of the herds.

White-tailed Deer. Only 4% (800 acres) of the CBCPA is white-tailed deer yearlong range, and no surface disturbance to white-tailed deer range would occur as a result of the No Action Alternative. In addition, white-tailed deer populations in the area are at or above WGFD objectives and are increasing. Thus, white-tailed deer populations are unlikely to be adversely impacted as a result of surface disturbance associated with the No Action Alternative. Adverse impacts most likely to affect white-tailed deer would be direct (e.g., collision with vehicles as a result of increased traffic in the area), but would not be significant.

Elk. Potential impacts to elk as a result of the No Action Alternative may be direct (e.g., collision with vehicles as a result of increased traffic in the area) and/or indirect (e.g., disturbance to or displacement from habitat, including winter/yearlong range). All of the CBCPA is elk winter/yearlong range except 100 acres that are outside the elk herd unit,. The No Action Alternative (mine and powerline) would result in a maximum disturbance of 3,270 acres (18% of the CBCPA), all of which is elk winter/yearlong habitat (see Table 4.13). However, no more than 1,523 acres would be disturbed at any one time [see Table 2.3]). In addition to direct loss of winter/yearlong habitat, elk may be displaced from winter/yearlong range immediately adjacent to disturbed areas as a result of increased human presence, noise, and physical barriers (e.g., fences, conveyors, mine facilities). Displacement from areas on or adjacent to proposed disturbance may result in the overuse and degradation of elk winter/yearlong range in the area. However, impacts to elk due to habitat modification are not anticipated to be significant nor are impacts due to potential collisions with vehicles.

Other Mammals. Potential adverse impacts to small mammals as a result of the No Action Alternative include direct mortality as a result surface disturbance and increased vehicular traffic, loss of habitat, and displacement of individuals from the area. The No Action Alternative would result in a maximum disturbance of 3,270 acres, no more than 1,523 acres of which would be disturbed at any one time [see Table 2.3]). The No Action Alternative likely would result in an unavoidable decrease in populations of these species in the area during the LOM; however, the high reproductive capacity of these species likely would enable populations to rebound and recolonize relatively quickly as the land is reclaimed. Therefore, impacts to small mammals would not be significant.

Raptors. Potential impacts for bald eagle, peregrine falcon, ferruginous hawk, burrowing owl, and merlin are discussed in Section 4.2.3. An additional 18 raptor species are known to occur or have the potential to occur within the CBCPA (see Section 3.2.2.2 and Appendix A). Osprey, sharp-shinned hawk, Cooper's hawk, broad-winged hawk, northern goshawk, long-eared owl, and northern saw-whet owl are primarily woodland species. No cottonwood bottoms would be disturbed within the CBCPA, and very little, if any, would be disturbed along the transportation or power line corridors, so impacts to these species likely would be minimal. Rough-legged hawk use of the area is restricted to winter months and barn owls are not known to breed in the CBCPA; thus, the primary impact to these species probably would be loss of potential foraging habitat. For the remaining nine species, some loss of available prey (to the extent that prey species would be excluded or displaced from the CBCPA) and loss or disturbance of approximately 3,270 acres of potential foraging and/or nesting habitat would occur until surface-disturbed areas are restored and reclaimed. Up to 1,523 acres would be disturbed at any given time (see Table 2.3). However, even after successful reclamation occurs, some irreplaceable loss of nesting habitat (e.g., cliffs, rock outcrops) would occur as a result of the No Action Alternative. Although raptor foraging, breeding, and nesting habitat occurs in adjacent areas, loss of these habitats due to mine development and operation may constitute a significant impact in specific areas where the habitat is removed. Loss of the habitat in the CBCPA is not expected to significantly affect the regional raptor population.

Direct impacts to raptors also may occur as a result of the No Action Alternative, including increased potential for bird-vehicle collisions (associated with increased traffic in the area) and for strike- or electrocution-related injury or death (associated with power lines and other facilities). This would constitute an illegal take under the *Migratory Bird Treaty Act* (MBTA), the *Bald Eagle Protection Act* (BEPA), and/or ESA, depending on the species affected and thus would constitute a significant impact.

The primary adverse impact to Swainson's hawk, golden eagle, prairie falcon, red-tailed hawk, northern harrier, turkey vulture, American kestrel, short-eared owl, and great horned owl may be loss of nesting habitat and disturbance of nests, which could result in displacement or reduced reproductive success of these species in the area. Based on known nests in the area (Intermountain Resources 1997; WEST 1997), 13 raptor nests may be taken or relocated as a result of the No Action Alternative (mine and power line), and an additional 47 nests are located within 0.75 mi of the proposed disturbance areas and may be indirectly impacted (i.e., avoided or abandoned) (see Figure 3.11). These 47 additional nests may be impacted by construction and/or activities associated with coal transportation. Arch has been conducting raptor nesting studies, taking nests, and deterring raptors from nesting on pit highwalls and near mining activities on the Hanna Basin mines for over 15 years under permits issued by and in cooperation with USFWS and WGFD. These activities have been conducted in compliance with the MBTA, BEPA, and state law. Despite the concern that raptors may be disturbed by mine activity within 0.75 mi, considerable effort has been expended over the past 15 years keeping raptors, primarily golden eagles and red-tailed hawks, from nesting on pit highwalls or near mine activity. The tolerance of human activity and tenacity of nesting attempts even with active efforts to deter appears to vary depending on individual birds, as well as species. Arch will apply the experience gained during previous raptor studies to assure that the appropriate measures are taken to minimize the adverse affects on a case-by-case basis in consideration of the site-specific situation at each nest that must be taken or is close enough to activity that it could potentially be disturbed. Federal and state permits must be obtained before a raptor nest can be taken, a plan to mitigate the take must be developed, and follow-up monitoring must be conducted. Arch submits annual reports on such activities to the agencies as part of the permit requirements. During the permitting process, the agencies make a determination that the take or deterrence activity will not significantly impact the raptor population before issuing a permit. Arch will continue to comply with all federal and state laws and regulations and will employ the process and techniques developed over the years to handle raptor nesting on and adjacent to mine activity such that impacts will not be significant.

Upland Game Birds. The No Action Alternative would result in a maximum disturbance of 3,270 acres, no more than 1,523 acres of which would be disturbed at any one time (see Table 2.3). Mourning doves may be displaced from heavily disturbed areas; however, this species often frequents areas of human disturbance (e.g., power lines, buildings, fences), and impacts to this species as a result of the No Action Alternative are not expected to be significant.

Four sage grouse leks are known to occur within 2.0 mi of the proposed surface mine (see Figure 3.13). Two of these leks were active in 1997 (Intermountain Resources 1997). The most recent years of activity for the remaining two leks are 1982 and 1991, respectively. On the basis of these four leks, approximately 123 acres of sage grouse breeding habitat (areas within 0.25 mi of a lek) and 2,751 acres of nesting habitat (area within 2 mi of a lek) would be directly impacted (i.e., surface disturbed) as a result of the surface mine (see Table 4.14).

Sage grouse wintering ground characteristics are roughly similar to nesting habitat, and several studies have suggested these areas be considered and managed as wintering-nesting complexes (Wallestad and Pyrah 1974; Wallestad 1975). Based on this premise, direct loss of and indirect disturbance to wintering grounds would be the same as that described for nesting habitat (i.e., surface disturbance of up to 123 and 2,751 acres of breeding and nesting habitat, respectively, as a result of the No Action Alternative) (see Table 4.14). An additional unquantifiable amount of winter habitat may be temporarily lost as a result of displacement due to human activity in the area. Sage grouse are expected to recolonize the

Table 4.14 Potential Disturbance to Raptor and Sage Grouse Habitat Within the CBCPA and Associated Transportation Corridors.[1,2]

	Raptors[4]		Sage Grouse[5]	
Proposed Disturbance[3]	No. Nests to Be Taken	Additional Nests Potentially Impacted[6]	Breeding Habitat (acres)	Nesting/Wintering Habitat (acres)
Surface Mine				
No Action (3,240 acres)	13 (3)	47 (10)	123	2,751
Proposed Action[7] (4,107 acres)	13 (3)	49 (0)	139	3,602
Increase due to Proposed Action	0 (0)	2 (10)	16	851
Power Lines				
P-1 (8 acres)	–	6 (0)	0	6
P-2 (30 acres)	–	3 (1)	0	18
Railroads				
R-1 (240 acres)	–	17 (4)	12	210
R-2 (256 acres)	–	26 (5)	0	144
Coal-handling facilities[8]				
CBCPA (170 acres)	–	1 (1)	0	170
Medicine Bow (170 acres)	–	–	0	0
Haul roads				
B-1 (267 acres)	–	10 (3)	16	168
B-2 (388 acres)	–	9 (3)	0	275
B-3 (533 acres)	–	10 (3)	36	267
D-1 (291)	–	25 (5)	0	146
Conveyors				
C-1 (67 acres)	–	13 (3)	8	45
C-2 (85 acres)	–	6 (0)	0	38
D-2 (67 acres)	–	13 (1)	0	41

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[1] See Figures 2.4-2.6 and 2.8 for the locations of each alternate transportation corridor.

[2] No Action Alternative would include either P-1 or P-2. The Proposed Action would include either P-1 or P-2 and either R-1 or R-2 and one or more of the other transportation corridors.

[3] Total disturbance acreage associated with the corridor is provided in parentheses.

[4] Total number of nests (including TEC&SC species discussed in Section 4.2.3) is given first, followed by the number of nests which were active in 1997 (in parentheses) (Intermountain Resources 1997; Western EcoSystems Technology, Inc. 1997). See Figure 3.11 for raptor nest locations relative to disturbance areas.

[5] Sage grouse breeding habitat is based on known historical and/or currently active leks and a 0.25-mi buffer; sage grouse nesting/wintering habitat is based on known historical and/or currently active leks and a 2.0-mi buffer. See Figure 3.13 for sage grouse lek locations relative to disturbance areas.

[6] Additional nests potentially impacted includes all nests within 0.75 mi of the proposed disturbance which would not be taken, but which may be adversely affected as a result of the disturbance.

[7] Within CBCPA only.

[8] Exact location unknown; based on estimated location.

reclaimed area when it is revegetated, although reclamation would be initiated as soon as possible after disturbance, resulting in a maximum of 1,523 acres of actual disturbance at any one time. The density and maturity of sagebrush required for suitable breeding, nesting, and wintering habitat in disturbed areas would require 20-100 years to reestablish. Thus, impacts to sage grouse due to habitat loss could be significant in the specific areas where the habitat is removed, but loss of the habitat is not expected to significantly affect the regional sage grouse population.

Direct impacts to sage grouse as a result of the No Action Alternative would be associated with raptor predation and bird-vehicle/bird-transmission line collisions. The potential for increased predation on sage grouse by raptors would be minimized by placing raptor antiperching devices on power line poles within 0.25 mi of known sage grouse leks. However, sage grouse may be injured or killed as a result of bird-vehicle collisions due to increased traffic in the CBCPA and bird-transmission line collisions due to the presence of new transmission lines. Wallestad (1975) reported that the most common cause of accidental sage grouse death was collision with vehicles. Deaths were highest during dry summers, when sage grouse utilized road ROWs as a source of green vegetation after range plants had dried up. Impacts due to direct mortality are not expected to be significant.

Waterfowl, Shorebirds, and Waders. Direct impacts to waterfowl, shorebirds, and waders would include increased potential for bird-vehicle collisions (associated with increased traffic in the area) and the potential for strike- or electrocution-related injury or death associated with transmission lines and other mine facilities. Indirect impacts may include displacement or disturbance of foraging and/or nesting areas; however, only 4 acres of riparian habitat (i.e., cottonwood bottoms, playa, and reservoir/stock pond) would be disturbed as a result of the No Action Alternative (see Table 4.11). Indirect impacts to these species would not be significant. Direct mortality would constitute an illegal take under the MBTA and thus would be significant.

Passerines. Direct impacts to passerine birds would include increased potential for bird-vehicle collisions (associated with increased traffic in the area) and the potential for strike-related injury or death associated with transmission lines and other mine facilities. Indirect impacts to passerines would include displacement or disturbance of foraging and/or nesting areas, especially for ground-nesting species. The No Action Alternative would result in loss or disturbance of approximately 3,270 acres of potential foraging and/or nesting habitat until surface-disturbed areas are restored and reclaimed. Since areas would be reclaimed as soon as possible after disturbance, no more than 1,523 acres would be disturbed at one time (see Table 2.3). Indirect impacts to passerines would not be significant; passerines are expected to recolonize the area; however, the avian species composition in the area may temporarily change, reflecting changes in vegetation during the LOM and the ensuing reclamation period. Direct mortality would constitute an illegal take under the MBTA and thus would be significant.

Amphibians and Reptiles. Potential adverse impacts to amphibians and reptiles as a result of the No Action Alternative include direct mortality (as a result of surface disturbance and increased vehicular traffic), loss of habitat, and displacement of individuals from the area. The No Action Alternative would result in a maximum disturbance of 3,270 acres, no more than 1,523 acres of which would be disturbed at any one time [see Table 2.3]). The No Action Alternative likely would result in decreased populations of these species in the area during the LOM; however, it is expected that these species would recolonize the area following reclamation, and impacts would not be significant.

Fisheries. Minor depletion of surface water is anticipated as a result of the No Action Alternative because surface water would be held in sediment ponds and, thus, would be lost due to evaporation and infiltration. An estimated 35 acre-ft/yr would be lost, or 0.027% of the mean annual discharge in the Medicine Bow River. Groundwater consumption by the mine is not expected to result in the depletion of surface water because there is little or no groundwater discharge to surface drainages within the CBCPA (see Section 4.1.8.2). Impacts to fisheries as a result of the No Action Alternative would not be significant.

4.2.2.2 Proposed Action

Under the Proposed Action, wildlife impacts would be similar to those described for the No Action Alternative except that up to 1,626 additional acres would be disturbed (a 50% increase over the No Action Alternative) depending on the transportation options selected and the length of time habitat is disturbed would be 11 years longer. It is anticipated that 5-10 ft of subsidence would occur as a result of underground mining. The subsidence process would occur slowly over time and likely would have minimal to no direct impact on wildlife in the area. However, subsidence would cause changes in topography (e.g., a landscape scored by regularly spaced ridges and depressions which retain snow) which may cause vegetative changes to occur; thus, components of wildlife habitat (e.g., forage and cover) may be indirectly impacted.

Tables 4.13 and 4.14 present the additional disturbance to key wildlife resources associated with construction and operation of the power lines and various transportation options. A summary of impacts to key wildlife resources for the Proposed Action and transportation options is presented in Tables 4.15 and 4.16. The Proposed Action will have the same types of impacts on the vegetation resources as the No Action Alternative; although more acres will be impacted, the significance of the impact would be generally the same as described for the No Action Alternative. With mitigation, management objectives would be met for all wildlife resources. None of the transportation corridors cross any identified big game migration corridors; however, there is big game movement within and adjacent to the CBCPA and transportation corridors.

Under the Proposed Action with transportation options 1 and 2 (over-the-road haulage from 2000 to 2005 followed by railroad haulage from 2005 to 2020) and option 3 (LOM railroad haulage) an additional 1,077-1,247 acres (a 33-39% increase over the No Action Alternative) would be disturbed due to the additional area that would be surface-mined and from railroad construction. Up to as much as 1,055-1,247 acres additional pronghorn crucial winter/yearlong range for a total potential disturbance of up to 4,517 acres (a 38% increase over the No Action Alternative) would be affected (Table 4.15). Disturbance of mule deer crucial winter range would increase by up to 58-228 acres (a 4-14% increase). Approximately 22-36 additional nests would potentially be within 0.75 mi and would be impacted (a 45-62% increase) (Table 4.16). An additional 11-28 acres and 1,013-1,249 acres of sage grouse breeding and nesting/winter habitat, respectively, would be affected (a 23% or 45% increase, respectively, over the No Action Alternative).

Under transportation options 4-6 (haul road haulage from 2000 to 2005 followed by railroad haulage from 2005 to 2020) surface disturbance and associated impacts would increase by 1,360-1,626 acres (42-50%) due to additional surface mining and development of one of three alternate haul roads (B-1, B-2, or B-3) and a railroad (R-1 or R-2). Disturbance in pronghorn crucial winter/yearlong range would be an additional 837 to 922 acres (26-28%) more than for the No Action Alternative for a total of 4,085-4,192 acres (Table 4.15). Disturbance in mule deer crucial winter/yearlong range would be 4% (58 acres) greater. Up to 41 more raptor nests would be potentially affected (Table 4.16). Disturbance in sage grouse breeding and wintering/nesting habitat would increase by up to 28-64 acres (23-52%) and 1,247-1,354 acres (45-49%), respectively.

Table 4.15 Minimum and Maximum Disturbance of Key Big Game Crucial Winter Ranges[1], No Action Alternative, Proposed Action, and Transportation Options.

Development Scenario	Maximum Disturbance	Pronghorn	Acreage (%) Increase from No Action Alternative	Mule Deer	Acreage (%) Increase from No Action Alternative
No Action	3,270	3,248-3,270	–	1,642-1,650	–
Proposed Action	4,107	4,085-4,107	837 (26)	1,700-1,708	58 (4)
Proposed Action and Transportation Option					
1	4,347	4,325-4,347	1,077 (33)	1,700-1,708	58 (4)
2	4,363	4,303-4,325	1,055 (32)	1,700-1,708	58 (4)
3	4,533	4,473-4,517	1,247 (38)	1,870-1,878	228 (14)
4	4,630	4,085-4,107	837 (26)	1,700-1,708	58 (4)
5	4,751	4,166-4,188	918 (28)	1,700-1,708	58 (4)
6	4,896	4,170-4,192	922 (28)	1,700-1,708	58 (4)
7	4,430	4,085-4,107	837 (26)	1,700-1,708	58 (4)
8	4,448	4,108-4,130	860 (26)	1,700-1,708	58 (4)
9	4,568	4,546-4,568	1,298 (40)	1,700-1,708	58 (4)
10	4,344	4,322-4,344	1,074 (33)	1,700-1,708	58 (4)

[1] Acreage varies depending on the power line and railroad routes analyzed.

Under transportation options 7 and 8, surface disturbance and associated impacts would increase by 1,160-1,178 acres (35-36% increase over the No Action Alternative). Additional disturbance would be associated with additional surface mining and construction of one of two alternate conveyors (C-1 or C-2) and the railroad (R-1 or R-2). An estimated 837-860 additional acres (26% increase over the No Action Alternative) of pronghorn crucial winter/yearlong range and 58 additional acres (4%) of mule deer crucial winter/yearlong range would be disturbed (Table 4.15). Thirty-five to 44 additional raptor nests would potentially be affected (Table 4.16). Disturbance within sage grouse breeding and nesting/wintering habitat would increase by up to 28-36 acres (23-29%) and 1,117-1,124 acres (37-41%), respectively.

In addition to surface disturbance, conveyors may impede the movement of big game within the CBCPA and surrounding area; however, Chervick (1991) indicated that in northern Colorado mule deer, pronghorns, and elk cows and calves readily passed under a conveyor with average clearance beneath the belt of 0.8 meters. Bull elk and buck mule deer avoided crossing under the belt due to antler clearance problems, but they would follow the belt and use overpasses and underpasses to cross. The conveyor is not expected to be a significant impediment to big game movement through the area. Additional impacts associated with these transportation options, over-and-above the mining impacts, would not be significant.

Under the no railroad options (options 9 and 10), surface disturbance and associated impacts would increase by 1,074-1,298 acres over the No Action

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Table 4.16 Minimum and Maximum Disturbance of Key Raptor and Sage Grouse Resources, No Action Alternative, Proposed Action, and Transportation Options.

Development Scenario	Raptor Nests Taken[1]	Increase (%) Over No Action Alternative	Additional Raptor Nests Potentially Disturbed[1,2]	Increase (%) Over No Action Alternative	Sage Grouse Breeding Habitat[3]	Increase (%) Over No Action Alternative	Sage Grouse Nesting/Wintering Habitat[3]	Increase (%) Over No Action Alternative
No Action Alternative	13 (3) - 16 (3)[4]	–	47-50	–	123	–	2,751	–
Proposed Action	14 (3) - 16 (3)	8	49-52	2 (4)	139	16 (13)	3,602	851 (31)
Transportation Option								
1	–	–	69-72	22 (44)	151	28 (23)	3,818-3,830	1,069 (39)
2	–	–	78-81	31 (62)	139	11 (9)	3,752-3,764	1,013 (37)
3	–	–	69-81	32 (62)	139-151	28 (23)	3,922-4,000	1,249 (45)
4	–	–	79-91	41 (82)	155-167	44 (36)	3,920-3,998	1,247 (45)
5	–	–	78-90	40 (80)	139-151	28 (23)	4,027-4,105	1,354 (49)
6	–	–	79-91	41 (82)	175-187	64 (52)	4,019-4,097	1,346 (49)
7	–	–	82-94	44 (88)	147-159	36 (29)	3,797-3,875	1,124 (41)
8	–	–	75-87	37 (74)	139-151	28 (23)	3,790-3,868	1,117 (41)
9	–	–	77-80	30 (60)	139-151	28 (23)	3,754-3,766	1,015 (37)
10	–	–	68-70	20 (40)	139-151	28 (23)	3,649-3,661	910 (33)

[1] Total number of nests (all species) is given first, followed by the number of nests which were active in 1997 (in parentheses) (Intermountain Resources 1997; WEST 1997).

[2] Additional raptor nests potentially impacted include all nests within 0.75 mi of the proposed disturbance which would not be taken or destroyed, but which may be adversely affected as a result of disturbance.

[3] Sage grouse breeding habitat is based on known historical and/or currently active leks and a 0.25-mi buffer; sage grouse nesting/wintering habitat based on known historical and/or currently active leks and a 2.0-mi buffer (Wallestad and Pyrah 1974; Wallestad 1975).

[4] Acreage varies depending on the power line and railroad routes analyzed.

Alternative (a 33-40% increase). Additional disturbance would be associated with increased surface mining and construction of a new coal-handling facility near Medicine Bow and either a haul road (D-1) or a conveyor (D-2). These options would result in disturbance of up to 1,298 additional acres of pronghorn crucial winter/yearlong range (a 40% increase over the No Action Alternative) and an additional 58 acres of mule deer crucial winter/yearlong range (a 4% increase) (Table 4.15). Up to 33 additional raptor nests occur within 0.75 mi of the corridors and would be potentially affected (Table 4.16). Impacts within sage grouse breeding and nesting/wintering habitat would increase by 28 acres (23%) and 910 to 1,015 acres (37%), respectively.

The maximum additional disturbance on pronghorn crucial winter range due to the Proposed Action with any of the transportation options is 1,298 acres more than for the No Action Alternative, resulting in a total disturbance of 4,568 acres. The 1,298 acres connected with the leasing of federal coal is 0.3% of the pronghorn crucial winter range within the Medicine Bow herd unit and the total disturbance is slightly under 1%. Although the Proposed Action would result in more acreage disturbed than the No Action Alternative, the additional acreage does not change the significance of the impact that would be present under the No Action Alternative. The impacts on pronghorn crucial range would be significant in the local area where the habitat is removed, but with mitigation, the Proposed Action would be consistent with the management objective of protecting crucial winter range, and the action should not have a significant impact at the population/herd count level. In a similar manner, only 58 acres more mule deer crucial winter range would be impacted by the Proposed Action and all transportation options except 3, which would remove approximately 228 more acres than the No Action Alternative. The type and significance of impacts to mule deer crucial winter range would be approximately the same for both the No Action and Proposed Action alternatives.

The additional acres of elk, other mammal, passerine bird, waterfowl, shorebird, waders, amphibians, and reptile potential habitat impacted by the Proposed Action above that impacted by the No Action Alternative is not of sufficient magnitude to cause the impact significance to be increased above that described for the respective wildlife groups for the No Action Alternative.

One additional raptor nest may need to be taken under the Proposed Action compared with the No Action Alternative in the areas to be mined and sufficient latitude is available on the transportation options such that nests can be avoided. The additional area covered by the Proposed Action and transportation options would result in the potential disturbance of an additional 20 to 44 raptor nests because they would occur within 0.75 mi of disturbance areas. Approximately 15 to 20% of the nests may be active in any one breeding season, so from 3 to 9 more active nests may be located within this potential disturbance area. Given that Arch would comply with the MBTA and BEPA, as discussed previously, and the tolerance of raptors to existing transportation corridors in the region (i.e., several of the nests monitored on the existing Hanna mines are immediately adjacent to roads and railroads), no significant impact to raptor nesting would be expected due to the transportation options.

The Proposed Action and transportation options would disturb up to 64 acres of sage grouse breeding habitat, over-and-above that disturbed under the No Action Alternative. The additional potential nesting/wintering habitat is 1,384 acres (Table 4.16). Impacts would be the same as for the No Action Alternative. The removal of these habitats would be significant at the site-specific local areas but are not expected to be significant at the regional population level.

4.2.2.3 Unavoidable Adverse Impacts

Unavoidable adverse impacts to wildlife and fisheries would be as described for the No Action Alternative and the Proposed Action.

4.2.2.4 Cumulative Impacts

The No Action Alternative would disturb up to 3,270 acres; acreage of disturbance under the Proposed Action would range from 4,322 to 4,896 acres, depending on the transportation options selected (see Table 2.2). Additional major sources of existing and proposed disturbance within the CIAA include the Medicine Bow, Seminoe I and II, Edison Development Company, Rosebud, and Cyprus-Shoshone mining operations; the SeaWest Wind Plant and Medicine Bow Windfarm; 12 oil and gas wells; and roads, railroads, and towns (see Table 4.1). Thus, including the Proposed Action, a total of 33,963 acres within the CIAA (6.0% of CIAA) is currently disturbed or is slated for disturbance in the reasonably foreseeable future. The abovementioned developments all contribute to an overall decline in some aspects of wildlife habitat (e.g., crucial winter range, raptor nesting and foraging habitat). The No Action Alternative and the Proposed Action approach disturbance of 1% of the crucial winter range for pronghorn and mule deer, and combined with other habitat disturbing activities in the CIAA, adverse cumulative impacts to these habitats are likely to occur. A total of 17,646 acres (3.2% of CIAA) in various stages of reclamation also occur within the CIAA (see Table 4.1), and much of this acreage likely does not yet support sufficient shrub cover to support the critical needs of some wildlife species (i.e., crucial pronghorn and mule deer winter range, sage grouse breeding, nesting, and wintering range). In addition, areas adjacent to disturbance may be avoided, or movement through or around those areas may be impeded; thus, for some species, the effective amount of habitat disturbance may be greater than the acreage of actual surface disturbance.

Mitigation measures for all federally approved projects are developed on a project-specific basis. In regards to coal mining, numerous mitigation measures are required by federal and state statutes to be incorporated into the mine permit to minimize impacts to wildlife. These measures generally include: 1) restoring the premining topography to approximate original contour; 2) planting a diverse mixture of grasses, forbs, and shrubs in configurations beneficial to wildlife; 3) designing fences to permit wildlife passage; 4) raptor-proofing power transmission poles; 5) creating artificial nest sites; 6) placing rock clusters and creating shallow depressions to add topographic diversity in reclamation; 7) reducing vehicle speed limits to minimize wildlife mortality; and 8) instructing employees not to disturb wildlife.

Arch would be required to conduct extensive wildlife monitoring prior to and during mine development and operations according to a WDEQ-approved wildlife monitoring plan. Wildlife monitoring has also been completed at Arch's Hanna Basin Mines. SeaWest is monitoring the Foote Creek Rim and Simpson Ridge project areas in accordance with the EIS, Plan of Development, RODs, and ROW grant for its Wind Plant development project. SeaWest is presently monitoring windpower development impacts on avian wildlife, big game, and small mammals, which, combined with Arch's monitoring, would provide a good database for wildlife population trends and mortalities. In addition, both BLM and WGFD monitor numbers of big game and sage grouse. Monitoring data would be used to detect fluctuations in populations and support adjustments in future project activities.

4.2.3 Threatened, Endangered, and Candidate Species and Species of Concern

4.2.3.1 No Action Alternative

Impacts to threatened, endangered, and candidate wildlife species and wildlife species of concern (TEC&SC) would be dependent on the presence or absence of each species within the CBCPA and the mitigation measures implemented to minimize adverse effects as a result of the project. If TEC&SC occur within the CBCPA, impacts may occur as a result of direct habitat loss associated with the surface mine and construction of facilities, power lines, and access roads. The degree of these impacts would be magnified where habitats of special significance (e.g., breeding or nesting areas) are disturbed. Some TEC&SC may be displaced from areas proposed for disturbance during at least a portion of the LOM. Mortality to individuals of TEC&SC may also occur as a result of collisions with facilities (e.g., power lines), vehicle/animal collisions due to increased traffic on the CBCPA, poaching and harassment associated with increased access in the area, or abandonment of eggs or young as a result of human activity and/or disturbance. No TE&C plant species are likely to occur within the CBCPA; therefore, no impacts to this resource are anticipated as a result of the mine development and operation.

A biological assessment is being prepared in conjunction with this EIS to address potential impacts to USFWS-listed TE&C species.

Black-footed Ferret. Although no recent black-footed ferret observations have been reported in the vicinity of the CBCPA, 1,450 acres of white-tailed prairie dog colonies (potential black-footed ferret habitat) occur within the CBCPA (see Figure 3.12), and most colonies have sufficient burrow densities (i.e., >8 burrows/acre) to warrant black-footed ferret surveys prior to disturbance (Intermountain Resources 1997). Under the No Action Alternative, approximately 262 acres of prairie dog colonies in the CBCPA would be disturbed for the surface mine and additional unquantified acreage may be disturbed during power line construction.

Ark would be required to monitor and inventory the lease area for establishment of potential black-footed ferret habitat (i.e., prairie dog towns) and, if any such habitat is found, to conduct ferret inventories, all in accordance with the guidelines below. In the event that ferret occurrence is identified, Ark would notify the BLM and USFWS and would be required to adhere to any modifications in the mining operation provided by the USFWS and the BLM to protect the endangered species.

The proposed coal lease lands and related facilities would be surveyed for prairie dogs before the project is approved. If prairie dogs are found on the proposed site, colonies would be mapped on topographic maps and each colony surveyed using recommended USFWS Black-Footed Ferret Survey Procedures. Ferret searches would be scheduled as close to actual construction as possible and not more than 1 year prior to disturbance to minimize the possibility of missing ferrets that might move onto the area during the period between completion of the surveys and the start of construction. Additional surveys or baseline studies for black-footed ferrets would probably be required throughout the LOM. Results of these surveys would be submitted to the BLM and USFWS for review and clearance. In addition, any burrowing owl nests would be noted and reported to BLM and USFWS. Power poles near prairie dog colonies would be equipped with raptor antiperching devices to minimize the take of prairie dogs or the potential take of black-footed ferrets and raptors. Since no black-footed ferrets are known to inhabit the CBCPA and surveys would be conducted, as required, prior to disturbance, no significant impacts to black-footed ferrets are anticipated as a result of the No Action Alternative.

Bald Eagle. Although no bald eagle nests are currently known to exist on the CBCPA, the area provides suitable foraging and nesting habitat for bald eagles, and several known bald eagle nests occur within approximately 2.0 mi of the CBCPA. Potential indirect impacts to bald eagles as a result of the No Action Alternative would be loss of available prey (i.e., birds and small mammals), to the extent that prey species would be excluded or displaced from the CBCPA, and loss or disturbance of approximately 3,270 acres of potential foraging habitat until surface-disturbed areas are restored and reclaimed. The impact to foraging bald eagles is expected to be minimal since bald eagle use of the area is infrequent and numerous prey species and suitable foraging habitat occur adjacent to the CBCPA. Since areas would be reclaimed as soon as possible after disturbance, no more than 1,523 acres would be disturbed at one time (see Table 2.2).

Direct impacts to bald eagles also may occur including increased potential for bird-vehicle collisions (associated with increased traffic in the area) and the potential for strike- or electrocution-related injury or death associated with transmission lines and other mine facilities. Direct mortality is unlikely but cannot be completely eliminated.

Loss of bald eagle foraging habitat would not constitute a significant impact. Direct mortality would be considered significant because it would constitute an illegal take under the ESA, the BEPA, and the MBTA.

Peregrine Falcon. No peregrine falcon nests or suitable peregrine falcon nesting habitats occur within the CBCPA and an approximately 2.0-mi buffer (Johnson et al. 1997; Intermountain Resources 1997); therefore, the No Action Alternative is not expected to have an adverse effect on breeding/nesting peregrine falcons.

Potential indirect impacts to peregrine falcons as a result of the No Action Alternative would be loss of available prey (i.e., birds, waterfowl, and small mammals), to the extent that prey species would be excluded or displaced from the CBCPA, and loss or disturbance of approximately 3,270 acres of foraging habitat until surface-disturbed areas are restored and reclaimed. Since areas would be reclaimed as soon as possible after disturbance, no more than 1,523 acres would be disturbed at one time (see Table 2.2). The impact to foraging peregrine falcons as a result of the No Action Alternative is expected to be minimal since peregrine falcon use of the CBCPA is infrequent and numerous prey species and suitable foraging habitat occur adjacent to the CBCPA.

Direct impacts to peregrine falcons also may occur as a result of the No Action Alternative, including increased potential for bird-vehicle collisions (associated with increased traffic in the area) and the potential for strike- or electrocution-related injury or death associated with transmission lines and other mine facilities. Direct mortality is unlikely but cannot be completely eliminated.

Loss of peregrine falcon foraging habitat would not constitute a significant impact. Direct mortality would be considered significant because it would be an illegal take and, thus, in violation of the ESA, the BEPA, and the MBTA.

Mountain Plover. During 1997 spring and summer surveys, an estimated six mountain plover breeding pairs were recorded using the north-central portion of the CBCPA (personal communication, August 21, 1997, with Jim Orpet, Intermountain Resources; Intermountain Resources 1997); thus, the potential exists for adverse impacts to mountain plovers as a result of loss of breeding/nesting habitat. Approximately 1,189 acres (6% of the CBCPA) of potential mountain plover nesting habitat currently exists within the CBCPA (i.e., pipeline reclamation, mine reclamation, grass/subshrub, and bottomland grassland habitat types). Of this total, approximately 187 acres (16%) would be surface-disturbed as a result of the proposed surface mine (see Table 4.11). Depending on the level of disturbance and the response of individual birds, breeding density and reproductive success within and adjacent to disturbed areas may decline, or the plovers may be displaced from the habitat altogether. If a reduction in breeding density and reproductive success occurs, it would be

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considered a significant local impact, but given the small amount of potential habitat disturbed (187 acres) relative to the overall range of the species in southern Wyoming and northern Colorado, it would not significantly affect the overall population. Federal, state, and local management objectives to provide habitat quality (food, cover, space, and water) would not be met while the area is disturbed but would be met once reclaimed.

Mountain plover mortality as a result of increased vehicular traffic is also a potential adverse impact, especially along unpaved roads in areas with sparse vegetation. Mountain plovers often feed near roadways (McCafferty 1930; Laun 1957), and Parrish (1988) found that mountain plover nest locations were positively correlated with proximity to roads, two-track ruts, and animal trails. Mountain plovers hesitate to fly when approached, preferring to freeze as long as possible or run quietly from the source of danger (Graul 1973; Parrish 1988). Thus, plovers and their nests and young may be vulnerable to vehicle-related mortality which would constitute an illegal take under the MBTA and, thus, would be significant.

Swift Fox. No observations of swift fox have been reported within the CBCPA; however, in 1991, one swift fox mortality was reported approximately 4 mi from the area, and scattered pockets of suitable habitat for this species exist within the CBCPA. Swift fox are probably rare visitors to the CBCPA. Approximately 187 acres of potential swift fox habitat (i.e., grass/subshrub, mine reclamation, bottomland grassland, hay meadow, and pipeline reclamation habitat types) would be surface-disturbed as a result of the proposed surface mine (see Table 4.11). Disturbance of approximately 254 acres of potential swift fox habitat as a result of the No Action Alternative would reduce potential habitat for this species; however, the impact to swift fox likely would be insignificant given this species' infrequent use of the area and the small amount of habitat removed.

Platte River Depletions. Since 1978, the USFWS has taken the position in its Section 7 consultations that federal agency actions resulting in water depletions to the Platte River system are likely to jeopardize the continued existence of the endangered whooping crane, endangered interior least tern, threatened piping plover, and endangered pallid sturgeon and adversely modify or destroy designated critical habitat. In addition, agency actions resulting in such water depletions may affect the continued existence of the endangered eskimo curlew, endangered American burying beetle, threatened Ute ladies' tresses orchid, and threatened western prairie fringed orchid. Under the No Action Alternative, Arch would construct approximately 13 sediment ponds with a total surface area of 12.9 acres and 93.28 acre-ft of storage. Assuming that evaporation rates would average 45 inches annually (Martner 1986), an estimated 35 acre-ft of surface water would be lost via evaporation. No surface water depletions due to groundwater consumption are anticipated because in the CBCPA, groundwater levels are well below, and thus do not discharge to, surface drainages. Any excess groundwater from dewatering, above and beyond that needed for dust suppression, would be stored in sediment ponds and eventually released to surface waters, thereby reducing, and perhaps compensating for, direct surface water depletions.

USFWS and/or WGFD Species of Concern. Five bat species of concern occur or potentially occur in the vicinity of the CBCPA (Clark and Stromberg 1987; personal communication, August 19, 1997, with Bob Luce, Nongame Biologist, WGFD, Lander); however, limited habitat (i.e., rock crevices, caves, mine adits) for these species occurs on the project area. In addition, bats are highly mobile and able to disperse into suitable habitat adjacent to the CBCPA. Thus, no significant impacts to bat species of concern are anticipated as a result of the No Action Alternative.

Use of the CBCPA by 16 of the 32 bird species of concern discussed in Section 3.2.3.1 (i.e., common loon; American white pelican; white-faced ibis; tundra swan; trumpeter swan; Caspian, Forster's, and black terns; snowy egret; black-crowned night heron; northern goshawk; Lewis' woodpecker; plain titmouse; bushtit; Bewick's wren; and veery) is likely limited primarily to the cottonwood bottoms along the Medicine Bow River corridor in the southeastern portion of the CBCPA. Very little, if any, of this habitat type would be disturbed as a result of the No Action Alternative. Because of the minimal disturbance to their preferred habitat and the infrequency with which the abovementioned species occur on the CBCPA, no significant impacts to these species are expected to occur as a result of the No Action Alternative. An additional eight species (ash-throated flycatcher, scrub jay, Baird's sparrow, upland sandpiper, gray flycatcher, Virginia's warbler, dickcissel, and chestnut-collared longspur) are infrequent visitors to the area; thus, no significant impacts to these species are anticipated as a result of the No Action Alternative.

Merlins are not known to breed in the vicinity of the CBCPA, and their use of the area appears to be limited to migration and winter periods. Since this species is highly mobile and suitable foraging habitat occurs adjacent to the CBCPA, impacts to this species as a result of the No Action Alternative would not be significant.

The loggerhead shrike, long-billed curlew, Brewer's sparrow, lark bunting, and McCown's longspur breed in the vicinity of the CBCPA (Dorn and Dorn 1990; TRC Mariah Associates Inc. 1995; Luce et al. 1997). Potential impacts to these species include mortality as a result of increased vehicular traffic and disturbance of breeding and foraging habitat, resulting in the potential destruction of active nests, interruption of nesting activities, or displacement of individuals from the area altogether. The No Action Alternative would result in a maximum disturbance of 3,270 acres, no more than 1,523 acres of which would be disturbed at any one time (see Table 2.2). The No Action Alternative may displace individuals of these species from the CBCPA during all or portions of the LOM; however, these species are highly mobile and suitable nesting and foraging habitat exists adjacent to the CBCPA. Impacts would not be significant.

As is the case for peregrine falcon and bald eagle, some loss of ferruginous hawk prey species and foraging habitat also would occur as a result of the No Action Alternative; however, the primary adverse impact to the ferruginous hawk would be loss of and disturbance to nests and nesting habitat, which may result in displacement or reduced reproductive success in the area. Four active and 79 inactive ferruginous hawk nests representing approximately 35 territories were located within the 1997 raptor survey area (see Figure 3.6) (Intermountain Resources 1997). Three of these nests would be taken as a result of the surface mine construction and operation, and an additional 30 may be adversely impacted (i.e., they occur within 0.75 mi of the proposed surface mine). However, even after successful reclamation occurs, some irreplaceable loss of nesting habitat (e.g., cliffs, rock outcrops) would occur as a result of the No Action Alternative. Given that Arch would continue addressing raptor nesting issues in conjunction with the USFWS and WGFD as described in Section 4.2.2.1, no significant impacts are expected for ferruginous hawk.

The burrowing owl is also a raptor species of concern known to breed in the general vicinity; however, no owls were observed in the area during 1997 wildlife surveys, nor are any nests of this species known to occur within the area. Potential impacts to burrowing owls include loss of prey species and foraging habitat and loss of potential nesting habitat. If burrowing owls establish nests within the area proposed for disturbance, loss of nest burrows would also be a potential impact. Burrowing owls and their nests are protected from take or disturbance under the MBTA; therefore, if destruction of a known nest was necessary, formal consultation and a take permit issued by USFWS would be required. Impacts to burrowing owl are not likely to be significant.

4.2.3.2 Proposed Action

Under the Proposed Action, impacts to TEC&SC species would be similar to those described for the No Action Alternative except that there would be more disturbance within the CBCPA due to additional surface mining, and more disturbance within and adjacent to the CBCPA due to potential coal-handling facility, railroad, haul road, and/or conveyor construction and the disturbances would be present for an additional 11 years. Under the Proposed Action, mining-related disturbances within the CBCPA would be up to 4,107 acres, or 859 acres (26%) more than for the No Action Alternative.

Site-specific data on TEC&SC have not been collected on the transportation corridors, so the amount of potential habitat for black-footed ferret, mountain plover, burrowing owl, and swift fox, etc., cannot be quantified at this time, nor are the data on ferruginous hawk nests complete for the various corridors. Up to 1,856 acres of bald eagle and peregrine falcon foraging habitat would be affected at any time (a 23% increase over the No Action Alternative). The transportation corridors would be surveyed for TEC&SC and their habitat prior to development and monitored after development according to the USFWS- and WDEQ-approved wildlife mitigation and monitoring plan. Given the attention paid to TEC&SC during development, and the requirements to avoid impact and mitigate any adverse effects, the Proposed Action and transportation alternatives would not have significant impacts on TEC&SC or their habitat unless inadvertent direct mortality occurs, as was described under the No Action Alternative. Platte River depletion would be as described for the No Action Alternative.

4.2.3.3 Unavoidable Adverse Impacts

Unavoidable adverse impacts on TEC&SC species would be as described for the No Action Alternative and the Proposed Action.

4.2.3.4 Cumulative Impacts

The No Action Alternative would disturb up to 3,270 acres. Disturbance acreage under the Proposed Action would range from 4,322 to 4,896 acres, depending on the transportation options selected (see Table 2.1). Additional major sources of existing and proposed disturbance within the CIAA include the Medicine Bow, Seminoe I and II, Edison Development Company, Rosebud, and Cyprus-Shoshone mining operations; the SeaWest and Medicine Bow Wind Plants; 12 oil and gas wells; and roads, railroads, and towns (see Table 4.1). Thus, including the Proposed Action, a total of 33,963 acres within the CIAA (6.0% of the CIAA) is currently disturbed or slated for disturbance in the reasonably foreseeable future. The abovementioned developments all contribute to an overall decline in some aspects of habitat for TEC&SC and sensitive species (e.g., mountain plover nesting habitat, ferruginous hawk nesting habitat). Windpower development may increase direct mortality of TE&C avian species; these impacts would be considered significant on a project-specific and cumulative basis.

Mitigation measures similar to those described in Chapter 5.0 would be implemented within the CIAA to minimize impacts to TE&C species for all federally approved projects, depending on project-specific circumstances.

4.3 CULTURAL AND HISTORIC RESOURCES

Federal, state, and/or county management decisions for cultural resources include the following:

- to protect and preserve representative samples of the full array of cultural resources for the benefit of scientific and socio-cultural use by present and future generations;

- to ensure that cultural resources are given full consideration in all land use planning and management decisions;
- to manage cultural resources so that scientific and socio-cultural values are not diminished, but rather are maintained and enhanced; and
- to ensure that the BLM's undertakings avoid inadvertent damage to cultural resources, both federal and nonfederal.

The No Action Alternative and Proposed Action would be consistent with these objectives.

4.3.1 No Action Alternative

Field inventories for cultural resources were completed within the CBCPA except for sec. 21-24, T.21 N., R.80 W., and sec. 19, T.21 N., R.79 W., which were added to the CBCPA after the 1997 surveys had been completed. Field inventories would be completed when these five sections are permitted.

Of the 41 significant or potentially significant cultural resource sites or components within the 1997 survey area, 10 are within the proposed disturbance area. All eligible sites would either be avoided or otherwise mitigated via an agency-approved data recovery program. At the time of draft EIS preparation, the Class III inventory report was in preparation, and it was not known which sites the agencies (BLM, SHPO, LQD, and OSM) would designate as eligible. Agency determination of eligibility would be required prior to implementing a testing program to determine the significance of potentially eligible sites. Native American consultation will be conducted to determine NRHP eligibility of sites important to Native Americans. With mitigation and monitoring, the No Action Alternative would not cause significant impacts to cultural resources.

4.3.2 Proposed Action

Under the Proposed Action, 29 potentially significant sites (26 prehistoric and three historic) would be disturbed during mine development and operation (19 more than for the No Action Alternative). With mitigation and monitoring, no significant effects to cultural resources would occur.

Under transportation options 1-10, impacts to cultural resources would be similar to those described for the No Action Alternative because the same agency-required identification, recordation, testing, and mitigation procedures would be applied. Class III inventories would be conducted along the corridors to be developed; inventory results would be used to develop and implement testing and mitigation measures, in consultation with other agencies and Native American groups, and thus no significant effects would occur.

4.3.3 Unavoidable Adverse Impacts

Both the No Action Alternative and the Proposed Action have the potential for inadvertent destruction of important cultural resource sites or sites with significance to Native Americans.

4.3.4 Cumulative Impacts

All federally approved projects would be conducted in compliance with the ARPA and the NHPA; therefore, cumulative impacts of development in the CIAA are not likely to adversely affect cultural resources except for the possible inadvertent destruction of unknown cultural resources.

4.4 SOCIOECONOMICS

There are no federal, state, and/or county management objectives for socioeconomics except as described for other resources (e.g., continued industrial development and agricultural expansion). These other objectives were used in the socioeconomic analysis. The No Action Alternative and the Proposed Action would be consistent with these objectives.

4.4.1 No Action Alternative

4.4.1.1 Employment

The No Action Alternative would continue employment opportunities for workers now employed at Arch's Medicine Bow and Seminoe II surface coal mines, both of which will likely be mined out by the year 2000. Numbers of employees at the new surface mine are presented in Table 2.9 and discussed in Section 2.1.7. Total employment would increase from 43 in 1999 to 114 in 2000, then drop to 92 by 2002. It would increase and then remain at 105 through 2007, after which it would drop to 13 by 2011 (see Table 2.9). An additional 54-60 contract truck drivers would be required for over-the-road coal haul trucks to haul coal from the mine to north of Hanna via Highway 72 for the LOM. Benefits to employment would be significant and beneficial.

The continuation of surface mining would continue to generate about $5.0 million/year (in 1996 dollars) in direct labor expenses for the life of the surface mine--about 11 years--as well as an additional $2.09 million/year in other purchases in the Carbon County economy. The additional 82 jobs not directly associated with the existing mine operations that generate about $1.42 million/year (UW 1996) would also continue for an additional 11 years. The Carbon County economy would also benefit from the additional employees required for driving the over-the-road trucks that would haul coal from the mine to the loadout near Hanna. Pedersen (1997) estimated that this would add an additional $7.0 million/year to the Carbon County economy. Another $7.0-8.0 million would be spent for the relocation and repair of the existing dragline at the Medicine Bow Mine during its move to the Elk Mountain Mine. Dragline renovation and moving, however, would generate relatively little to the Carbon County economy because much of the work would involve specialized contractors based in Gillette or Casper, Wyoming. Pedersen (1997) summarizes the impacts to Carbon County from the Proposed Action by saying, "If the intended mine expansion plans of Arch of Wyoming are realized, the economy of Carbon County will be significantly strengthened beginning in the year 2001."

4.4.1.2 Population

Under the No Action Alternative, an estimated 2-24 additional workers would be required for approximately 8 years during surface mining. All workers would be hired from applicants registered with Job Service of Wyoming; however, nonlocal workers can and do register with Job Service of Wyoming. Workers for the surface mine would likely come from the local work force, and so only a few, if any, workers and their families would move to Carbon County as a result of this project. Impacts to population would not be significant under the No Action Alternative.

4.4.1.3 Housing

Because most of the workers at the Elk Mountain Mine would be local hires, there would be little demand for additional housing under the No Action Alternative. There are more than 1,300 vacant units in the general vicinity of the proposed project, so the 2-24 additional workers and their families would be able to find housing; however, the quality of unoccupied housing is likely low in many cases. These workers would be well-paid and could afford to build houses, remodel existing units, or purchase mobile homes if existing housing is of unacceptable quality or is inadequate. Therefore, impacts to housing would not be significant under the No Action Alternative.

4.4.1.4 Schools

Because relatively few new nonlocal workers would be hired and because Carbon County schools are capable of handling higher enrollments, impacts to schools would not be significant under any of the transportation options.

4.4.1.5 Local Government Taxation and Revenue

Economic Impact of Coal on Wyoming's Economy (Borden et al. 1994) estimates that each ton of coal from southern Wyoming contributes $4.98 in taxes and royalties--$1.37 in severance tax, $1.30 in ad valorem tax (property and production), $0.13 in sales and use tax, $0.85 in federal taxes, and $1.33 in royalty payments to the federal government. All but the federal taxes and one-half of the royalty payments to the federal government are returned to Wyoming. Therefore, approximately $3.47 are returned to Wyoming for each ton of coal mined.

Based on these estimates, approximately $112 million in taxes would be generated by the No Action Alternative, of which $78 million would benefit Wyoming. These revenues would be significant and beneficial.

4.4.1.6 Community Characteristics, Facilities, and Infrastructure

Impacts on community characteristics due to the No Action Alternative would not be significant because the population and economy would continue as in the past for the LOM.

4.4.1.7 Transportation

Under the No Action Alternative, coal from the surface mining operations would be hauled via over-the-road haul trucks to the Seminoe II loadout north of Hanna via Highway 72 for the LOM--approximately 8 years. The principle impact to transportation would be the increased traffic, especially on Highway 72, by mine employees commuting to and from work and by construction equipment and possibly over-the-road coal haul trucks, depending on the transportation option selected (see Table 2.8). Assuming that all vehicles would utilize Highway 72, average daily traffic would increase about 55% (Table 4.17) during construction from October 1999 to February 2000 as compared to 1996 traffic volumes, which included an average of 290 vehicles per day, 40 of which were trucks. Surface mine operations would increase traffic to 52-188 vehicles per day, plus an additional 180-436 coal haul trucks per day during the first 3-5 years of surface mining. This would be an increase of 80-228% over 1996 traffic volumes, assuming all vehicles use Highway 72, and an increase of 450-1,090% in truck traffic. Haul truck traffic to serve local customers would average 22 vehicles per day, other truck traffic would be limited to water trucks and various delivery trucks at a rate of 18-26 vehicles per day and car/pickup traffic would range from 34 to 198 vehicles per day until operations would cease in 2007 (a 65% increase in the number of trucks and a 68% increase in the number of cars/pickups as compared to 1996). These volumes include 30 cars/pickups and six large trucks required for reclamation. During final reclamation, traffic would include 40 vehicles per day by cars/pickups and 6 vehicles per day by large trucks (14% and 15% increases as compared to 1996, respectively).

Over-the-road trucks hauling 40 tons of coal would be properly permitted and no violations of Wyoming Department of Transportation regulations would occur as a result of this activity. However, it is likely that such traffic would damage the surface of Highway 72 and that a 2-inch overlay of asphalt pavement at a cost of approximately $160,000 per mile would be required to adequately support the additional truck traffic (Harvey 1998; personal communication, February 1998, with Jay Gould, Wyoming Department of Transportation). In addition, increased traffic volume would increase the likelihood of traffic accidents, although the possibility of accidents would be mitigated by using professional truck drivers, by avoiding use of the road by trucks during times when school buses are using the road, and by proper signing.

Table 4.17 Average Daily Traffic Comparison, No Action Alternative and Proposed Action.

Operation/ Year	No Action Alternative	% Increase Over 1996 Levels[1]	Proposed Action	% Increase Over No Action Alternative	% Increase Over 1996 Levels[1]
Mine Development and Operations					
1999	160	55	160	0	55
2000	52-188	18-65	52-188	0	18-65
2001	52-224	18-77	52-224	0	18-77
2002	52-224	18-77	52-224	0	18-77
2003	52-224	18-77	52-224	0	18-77
2004	52-224	18-77	112-416	186-215	39-143
2005	52-224	18-77	112-416	186-215	39-143
2006	52-224	18-77	152-420	188-292	52-145
2007	52-224	18-77	152-420	188-292	52-145
2008	46	16	152-420	330-913	52-145
2009	46	16	152-420	330-913	52-145
2010	46	16	152-420	330-913	52-145
2011	46	16	100-232	330-913	34-80
2012	46	16	100-232	330-913	34-80
2013	0	0	100-232	330-913	34-80
2020	0	0	100-232	n/a	34-80
2021	0	0	46	n/a	16
2022	0	0	46	n/a	16
2023	0	0	46	n/a	16

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[1] In 1996, average daily traffic included 290 vehicles, 40 of which were trucks.

Table 4.17 (Continued)

Operation/ Year	No Action Alternative	% Increase Over 1996 Levels	Proposed Action	% Increase Over No Action Alternative	% Increase Over 1996 Levels
Coal Haul Trucks					
1999	0	0	0	0	0
2000	180-436	62-150	222-900	23-106	77-310
2001	180-436	62-150	222-900	23-106	77-310
2002	180-436	0	222-900	23-106	77-310
2003	180-436	0	222-900	23-106	77-310
2004	180-436	0	222-900	23-106	77-310
2005	180-436	0	222-900	23-106	77-310
2006	180-436	0	22	-88	8
2007	180-436	0	22	-88	8
2008	0	0	22	n/a	8
2009	0	0	22	n/a	8
2010	0	0	22	n/a	8
2011	0	0	22	n/a	8
2012	0	0	22	n/a	8
2013	0	0	22	n/a	8
2020	0	0	22	n/a	8
2021	0	0	0	n/a	0
2022	0	0	0	n/a	0
2023	0	0	0	n/a	0

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There could be a 1,140% increase in truck traffic. Traffic volume (up to 914 vehicles per day) would exceed Highway 72 design standards (744 vehicles per day) by 170 vehicles (23%). Arch is currently negotiating with the Wyoming Department of Transportation to develop mitigation for this impact which, without mitigation, would be significant. Loss of life and property due to accidents would also constitute a significant impact. The increased traffic volume would increase the likelihood of traffic accidents, especially at intersections such as the junction of Highway 72 and 30/287 where haul trucks returning to the mine would have to make a left-hand turn across traffic. No other impacts would be significant because no violations of Wyoming Department of Transportation regulations would occur.

4.4.2 Proposed Action

4.4.2.1 Employment

In addition to the jobs created by the surface mine, the Proposed Action would provide additional employment opportunities in underground coal mining beginning in about 2004. Numbers of employees at the new surface and underground mining operations are presented in Table 2.16 and discussed in Section 2.2.7. Beneficial impacts from surface mine development would be as described for the No Action Alternative.

The underground mine would begin to contribute to the Carbon County economy in 2004 and from 2007 through 2020 would employ a minimum of 210 employees and five contract workers (see Table 2.16). Pedersen (1997) estimates this would generate $12.8 million/year of new direct expenditures to the Carbon County economy. The input of these direct expenditures would likely create about 140 jobs of indirect employment generating an additional $2.4 million/year of indirect income to other Carbon County residents. Together, the surface and underground mines would create an additional 89-207 jobs for approximately 17 years, or 87-183 more new jobs than under the No Action Alternative, for an additional 11 years.

Employment under transportation options 1 and 2 would call for 54-60 contractor truck drivers from 2000 to 2005, which is the same as for the No Action Alternative. Seven contractors/employees would be required thereafter to operate the railroad and coal-handling facility. This would be a decrease of 47-53 workers from 2005 to 2007 and an increase of seven workers from 2008 to 2020.

Employment under transportation option 3 would differ from that under the No Action Alternative because over-the-road coal truck drivers would not be needed to haul coal from the mine to the loadout facilities north of Hanna during of operations. This would reduce benefits to the Carbon County economy by about $7.0 million/year as compared to the No Action Alternative.

Employment under transportation options 4, 5, and 6 would be lower than for the No Action Alternative because fewer coal truck drivers would be needed to haul coal from the mine to the loadout facilities north of Hanna because coal would be hauled in 200-ton trucks rather than over-the-road trucks hauling 40-tons. Therefore, only about 6-17% as many drivers would be needed, and benefits to the Carbon County economy would be reduced by an approximately proportionate amount--from $7.0 million/year to $0.4-1.2 million/year.

Employment under transportation options 7 or 8 would differ from that under the No Action Alternative because over-the-road coal truck drivers would not be needed to haul coal from the mine to the loadout facilities north of Hanna; rather, coal would be transported via conveyor. An estimated 54-60 workers would not be required, which would reduce benefits to Carbon County by about $7.0 million/year. A few additional construction workers would be required to construct the conveyor (12 workers for 6 months).

An estimated 3-10 contracted 200-ton haul truck drivers would be required under transportation option 9 for the LOM. Coal would continue to be transported via truck for the LOM--no railroad would be built. This would decrease the demand for truck drivers from 2000 to 2007 and increase the demand from 2008 to 2020; however, employment of railroad construction workers would not be required.

An estimated 12 conveyor operators would be employed under transportation option 10 if a conveyor would be chosen to transport of coal from the mine to the railroad loadout at Medicine Bow. Coal would continue to be transported via conveyor for the LOM--no railroad would be built. This alternative would eliminate the need for drivers for haul trucks as well as employment of railroad construction workers.

Impacts to employment under all transportation scenarios would be significant and beneficial.

4.4.2.2 Population

Under the Proposed Action, additional workers would be required as the underground mining comes on line, in addition to the workers that would transfer from existing mines to the proposed surface mine. All workers would be transferred from the Medicine Bow and Seminoe II mines or hired from applicants registered with Job Service of Wyoming in Rawlins; however, nonlocal workers can and do register with Job Service of Wyoming. Workers for the underground mine would come from the local work force when possible (the start-up year for this operation approximates the closure of the Cyprus-Shoshone Mine); however, it is likely that a significant number of new workers would come from outside the local area, especially in instances where expertise in certain aspects of underground mining would not be available locally. Once surface mining is completed, workers no longer required for surface operations could replace workers that leave underground operations due to normal attrition, assuming the surface mine workers had the appropriate skills, or could be retrained. However, it is likely that about 100 additional workers and their families would move to Carbon County to work in the underground mine. Assuming that the average family size of new nonlocal workers is two, the population would increase by about 200 individuals, a 1.3% increase in the 1996 estimated population of Carbon County and a 1.3% increase over the little to no increase expected under the No Action Alternative. Such an increase would not constitute a significant impact on population, especially given that Carbon County's population has decreased by approximately 800 since 1990.

Impacts under all transportation options would also create an estimated 1.3% population increase, over that expected for the No Action Alternative due to underground mine development; no notable increase or decrease due to coal haulage are expected because a majority, if not all, haulage-related workers would be hired/contracted locally.

Impacts to population would not be significant under any of the transportation options.

4.4.2.3 Housing

Because an estimated 100 workers and their families would move to Carbon County under the Proposed Action, there would be a slightly greater demand for housing than under the No Action Alternative. There are more than 1,300 vacant units in the general vicinity of the proposed project, so the 100 additional workers and their families would be able to find housing; however, the quality of the unoccupied housing is likely low in many cases. These workers would be well-paid and could afford to build houses, remodel existing units, or purchase mobile homes if existing housing is of unacceptable quality or is inadequate.

Demands for housing under all transportation options would be slightly higher than for the No Action Alternative due to the immigration of mine workers. A majority of coal transportation workers would be locally hired/contracted, and

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thus little if any additional housing would be needed. Impacts to housing would not be significant under any of the transportation scenarios.

4.4.2.4 Schools

Because relatively few new nonlocal workers would be hired and because Carbon County schools are capable of handling higher enrollments, impacts to schools would not be significant under any of the transportation options.

4.4.2.5 Local Government Taxation and Revenue

Based on estimates by Borden et al. (1994), approximately $593 million in taxes would be generated by the Proposed Action, of which an estimated $413 million would benefit Wyoming. Annual contributions to Wyoming from such taxes would range from $4.4 million to $26.8 million and would be highest during those years in which underground mining occurred. These revenues would be a 283% increase over those created under the No Action Alternative, would be significant and beneficial, and would be similar under all transportation options.

4.4.2.6 Community Characteristics, Facilities, and Infrastructure

Impacts to community characteristics, facilities, and infrastructure would be similar to that described for the No Action Alternative. Because of the relatively small change in population due to the Proposed Action, community characteristics would likely change very little, and impacts would not be significant, regardless of the transportation option chosen.

4.4.2.7 Transportation

Traffic volumes during surface mine development would be similar to those described for the No Action Alternative but would increase by up to 215% (over the No Action Alternative) during underground mine development in 2004-2006 (Table 4.17). Mine development and operation, in combination with transportation options 3-10, would not cause exceedences of the design standard for volume of traffic on Highway 72. Loss of life and property due to accidents would constitute a significant impact for the Proposed Action and all transportation options.

Under transportation options 1 and 2, impacts due to additional traffic would be similar to those described for the No Action Alternative except that over-the-highway haulage would cease in 2005 rather than 2007. Elevated traffic levels (up to 100-232 vehicles per day) (see Table 4.17) would continue for the LOM due to underground mining activities, railroad and coal-handling facility operations, and reclamation. The design standard for volume of traffic would be exceeded by up to 572 vehicles per day (up to 416 vehicles per day for mine development operations plus up to 900 coal haul trucks per day (see Table 4.17) (76%) from 2000-2005 during surface mining and over-the-road haulage. Arch is currently negotiating with the Wyoming Department of Transportation to mitigate this impact, which would be significant without mitigation.

Under transportation option 3, all of the impacts in the No Action Alternative associated with hauling coal on Highway 72 would be avoided. Traffic would still increase on Highway 72 as a result of miners commuting to and from work, as well as from increased truck traffic, but these impacts would be not be significant.

Under transportation options 4, 5, and 6, coal would be transported from the mine to the loadout north of Hanna in 200-ton haul trucks via a haul road roughly paralleling Highway 72 during the first 5 years of mining. This would reduce truck traffic on Highway 72 and avoid the associated road damage and safety concerns. Impacts to transportation would not be significant.

The use of a conveyor to transport coal from the mine to the loadout facilities (transportation options 7 or 8) would eliminate the need for over-the-road coal haul trucks to use Highway 72. The roads would be used for employees commuting to and from the mine and for trucks delivering coal locally and bring supplies and equipment to the mine. Impacts would not be significant for the LOM and beyond.

Impacts to transportation resulting from the use of a conveyor to transport coal from the mine to the loadout facility at Medicine Bow (transportation option 10) would not be significant, nor would impacts resulting from the use of 200-ton haul trucks using a designated haul road (transportation option 9). Impacts would result primarily from safety concerns regarding trucks crossing Highway 30/287.

4.4.3 Unavoidable Adverse Impacts

There would be no unavoidable adverse impacts to socioeconomics due to the No Action Alternative or the Proposed Action. Selection of the Proposed Action would result in a significant increase in employment and revenues after the year 2007 as compared to the No Action Alternative (see Section 4.4.1.1). Loss of life and property due to accidents would be a significant unavoidable adverse impact.

4.4.4 Cumulative Impacts

The No Action Alternative would continue surface mining for an additional 8 years after coal resources are depleted at existing Arch mines, providing continued economic benefits to Carbon County at approximately existing levels. The Proposed Action mine would continue mining for an additional 24 years and would provide employment and economic benefits to Carbon County at a level that would replace the losses to the county upon the closure of the existing Cyprus-Shoshone underground mine. If the Cyprus-Shoshone Mine would expand to the Barrel Springs area, significant additional employment and economic benefits would occur for the relatively short LOM.

No data are available for the proposed Medicine Bow windfarm. The SeaWest Wind Plant Project, however, could provide an average annual payroll of about $2.4 million for its 40-year life (BLM 1995a, 1995b). Once construction is completed, up to seven windsmiths will be employed for the life-of-project (BLM 1997d). Average annual operations and maintenance personnel salaries will be $30,416, and most workers will come from the local workforce.

Pedersen (1997) summarized anticipated economic expansion in Carbon County by stating, "Future economic expansion to the year 2015 is promising in all industries and primary employers that comprise the economic base of Carbon County."

4.5 LAND USE

Federal, state, and/or county management objectives for various land uses are as follows:

- to support the goals and objectives of federal resource programs for managing the BLM-administered public lands and to respond to public demand for land use authorizations;
- to protect natural resources while meeting the economic and social needs of the people;
- to maintain and develop a satisfactory living environment within the county;
- to enhance livestock grazing while maintaining a balance between economic uses and the enhancement of wildlife habitat, watershed, and riparian areas, while maintaining or improving range condition over the long term;
- to ensure the continued availability of outdoor recreational opportunities, to meet legal requirements for the health and safety of visitors, and to mitigate conflicts with other resources users;
- to ensure continued exploitation of gravel, coal, oil, and gas resources on agricultural lands; and

- to provide public facilities and services including safe and efficient transportation and utility systems.

These land use objectives would be met under the No Action Alternative and the Proposed Action.

4.5.1 No Action Alternative

4.5.1.1 Agriculture/Rangeland

Under the No Action Alternative, existing land use of grazing, wildlife habitat, and dispersed outdoor recreation would continue, although as somewhat reduced rates during the LOM. Public access to lands controlled by Arch for dispersed recreation would continue as it exists today, except that access would be denied in close proximity to active mining operations to ensure public safety, and newly reclaimed lands would, in most locations, be temporarily fenced to exclude livestock until vegetation would be reestablished. Some amount of various wildlife habitats would be disturbed during mining operations (see Section 4.2.2, Wildlife and Fisheries). Based on 5.3 acres per AUM, 3 AUMs (<1% of the 2,057 available AUMs on the project area) to 293 AUMs (14% of the AUMs on the project area), and an average of 166 AUMs (8% of the AUMs on the project area) would be unavailable for grazing use during the years 1999 to 2012. The majority of these AUMs would be on the North Aaschutz allotment. The temporary loss of AUMs within the CBCPA includes AUMs on private land; as well as BLM and state land. Some or all federal AUMs would be suspended until such time that the disturbed land is reclaimed and is suitable for grazing. Fencing of reclaimed lands may block access to other undisturbed grazing lands. All private grazing lands (owned and leased by Arch) are leased to one permittee on a year-to-year basis, so Arch and the permittee will make appropriate arrangements. Reclaimed lands would likely be closed to livestock grazing for several years and may block livestock access to other unreclaimed areas. Therefore, impacts to livestock grazing could be greater than just the loss of disturbed/reclaimed lands.

4.5.1.2 Extractive Mineral Operations/Oil and Gas Production

No producing oil or gas wells occur within the permit area, so none would be disturbed by mining operations. Oil and gas exploration and development could occur during mining if such activities did not interfere with mining operations. The existing oil and gas leases represent a prior existing right, and the lease holders can develop these leases at any time. Arrangements for any such oil or gas operations would have to be negotiated between Arch and the oil/gas developer. The same situation applies to locatable minerals within the project area. It is likely that oil/gas development would be incompatible with mining over much of the project area for the LOM. However, no other mineral operations or oil/gas development occur within the project area at this time. Impacts would not be significant.

4.5.1.3 Recreation

There would be no change in the general policy regarding access to the project area by hunters or other recreationists during the LOM, except that access would be restricted in areas immediately adjacent to active operations because of public safety considerations. Hunters and other recreationists would be required to register with Arch and obtain a permit to access lands within the permit area, but such access would not be unreasonably withheld. This is the same policy that now exists in the CBCPA. Noise and visual intrusions associated with mining would likely detract from the attractiveness of the project area for such activities during the LOM. Recreationists would be impacted, but not significantly.

4.5.1.4 Land Status and Prior Rights

All roads, power lines, pipelines, and other ROWs would be crossed using best management practices. Owners would be notified and all reasonable precautions would be taken to ensure the integrity of the ROW being crossed. The cost of any relocations of facilities would be borne by Arch and conducted in cooperation with the ROW holder. Therefore, impacts to existing ROWs would be negligible. Arch would own or lease all private lands within the project boundary; therefore, there would be no change in private/federal/state landownership.

4.5.2 Proposed Action

4.5.2.1 Agriculture/Rangeland

Under the Proposed Action and based on 5.3 acres per AUM, 11 AUMs (<1% of the 2,057 available AUMs on the project area) to 357 AUMs (17% of the AUMs on the project area), and an average of 181 AUMs (9% of the AUMs on the project area) would be unavailable for grazing use during the years 1999 to 2021. The majority of these AUMs would be on the North Anschutz allotment. The temporary loss of AUMs within the CBCPA includes AUMs on private land, as well as BLM and state land. Some or all federal AUMs would be suspended until such time that the disturbed land is reclaimed and is suitable for grazing. Fencing of reclaimed lands may block access to other undisturbed grazing lands. All private grazing lands (owned and leased by Arch) are leased to one permittee on a year-to-year basis, so Arch and the permittee would make appropriate arrangements. BLM would make arrangements with the permittee who has leased the federal surface.

Impacts under transportation option 3 would be of the same type as under transportation options 1 or 2; however, an additional 170 acres would be disturbed for the coal-handling facility, resulting in a loss of an additional 32 AUMs of livestock grazing for the LOM.

Impacts under transportation options 4, 5, or 6 would be of the same type as under transportation options 1 or 2; however, an additional 267-533 acres would be disturbed for the haul road, resulting in a loss of an additional 50-101 AUMs of livestock grazing for the LOM. If the haul road would be constructed roughly paralleling Highway 72, most of the loss of AUMs would occur in the Dana Meadows South Allotment. Otherwise, most would occur in the Chase Allotment.

Impacts under transportation options 7 or 8 would be of the same type as under transportation options 1 or 2; however, an additional 67-85 acres would be disturbed for the coal conveyor, resulting in a loss of an additional 13-16 AUMs of livestock grazing for the LOM.

Impacts under transportation option 9 or 10 would be of the same type as under transportation options 1 and 2; however, 205-221 more acres (39-42 AUMs) would be disturbed for the coal haul road, and 3-19 fewer acres (1-4 AUMs) would be disturbed with the conveyor.

Once successfully reclaimed, the range would be expected to produce livestock forage in quantities similar to predisturbance levels so impacts would not be significant.

4.5.2.2 Extractive Mineral Operations/Oil and Gas Production

No producing oil or gas wells occur within the permit area, so none would be disturbed by mining operations. Public lands would remain open to oil and gas leasing. The existing oil and gas leases represent a prior existing right, and the lease holders can develop these leases at any time. Concurrent development of oil and gas with coal would be encouraged as long as it did not result in significant loss of federal coal. On a case-by-case basis, appropriate stipulation(s) would be placed on new oil and gas leases issued in areas open to coal development and further leasing consideration.

The rights granted in a coal lease would be subject to prior existing rights of oil and gas leases encumbering all or part of the same acreage.

BLM retains the authority to alter or modify coal operations on lands covered by oil and gas leases to avoid interference with prior existing rights.

4.5.2.3 Recreation

Impacts under the Proposed Action would be of the same type as under the No Action Alternative except that there would be up to 1,628 acres of additional disturbance and the duration of impact would be 11 years longer. The haul road and conveyor options could somewhat reduce the quality of recreational experience in the Carbon Basin, but impacts are not expected to be significant.

4.5.2.4 Land Status and Prior Rights

Impacts to land status and prior rights under the Proposed Action would not be significant as with the No Action Alternative. There would be no impacts to landownership.

4.5.3 Unavoidable Adverse Impacts

There would be no unavoidable adverse impacts to land status/use or oil, gas, and mineral exploration and development. The No Action Alternative and the Proposed Action would result in long-term loss of livestock forage and available AUMs. Recreational opportunities would be lost in the CBCPA and vicinity primarily because recreationists would be excluded from portions of the project area for safety reasons, and for reclamation success.

4.5.4 Cumulative Impacts

Numerous projects in the CIAA have or would result in surface disturbance. Mines within the CIAA have already disturbed and reclaimed 17,646 acres. An estimated 21,252 acres are currently disturbed or proposed for disturbance and would likely be reclaimed shortly after the turn of the century. All of these lands would be capable of supporting predisturbance uses once reclamation is complete, and these uses generally include livestock grazing, recreation, and wildlife habitat. Of the 60,619 acres in the SeaWest Windpower Project only 1,787 acres (3%) would be disturbed, and the remainder would support existing uses without significant impairment. Disturbance from oil/gas development is not a significant factor in the CIAA, and disturbance from roads, railroads, and towns is necessary for human habitation. All of these various land uses are part of the economic development scenario for the CIAA, and none detracts significantly from the area's ability to support a diverse landscape that also supports livestock grazing, wildlife habitat, and recreation; therefore, no significant cumulative impact is expected.

4.6 VISUAL RESOURCES

Federal, state, and/or county management objectives for visual resources are to minimize adverse effects on visual resources while maintaining the effectiveness of land use allocations and to conserve and develop scenic resources for the benefit of present and future generations. Any development in a VRM Class III area that would begin to dominate or would dominate the landscape would be considered a significant visual impact.

The people that would view the mine most frequently would be miners. There would also be two other primary types of viewers: those traveling on I-80 and Highways 72 and 30/287 and those off-highway viewers, such as ranchers, recreationists, developers, who would be in and adjacent to the CBCPA and along the transportation corridors. This distinction is made because the perception that a development begins to dominate or dominates the landscape would depend on the distance from which it was viewed, as well as viewer sensitivity and other landscape features. Not all viewers would view the visual impacts as negative--some may perceive the development as a high interest activity in an otherwise barren landscape and may take interest in the opportunity to observe the coal mining process. Thus, the analysis presented below focuses on whether or not BLM VRM management objectives would be met, thereby minimizing the subjectivity inherent in visual aesthetics.

During scoping, some commentors expressed concern that the mine would be visible from I-80. Because of this concern and because most potential viewers would be on I-80 and, secondarily, on Highway 72, the visual impact analysis focused on how the mine would look from the I-80 and Highway 72 corridors. A second part of the analysis considered how the mine and facility would look to off-highway viewers. VRM objectives for Class III areas would be violated for viewers in the vicinity of the mine or transportation corridors, so some viewers would be significantly impacted.

4.6.1 No Action Alternative

The proposed mine plan involves placement of overburden and topsoil stockpiles along the western, southern, and eastern edges of the mine (i.e., facing I-80 and Highway 72) (see Figure 2.2), and since these would be up to 100 ft high, they and the 200-ft tall dragline would be the only visible features of the mine from these highways. Although the spoil piles would add 100 ft to the existing landscape, and the dragline would extend another 100 ft above them, topography along I-80 and Highway 72 would effectively screen the mine from view except for approximately 0.5 mi along I-80 and 1.0 mi along Highway 72 (Figure 4.8). Appendix C presents 12 topographic cross-sections taken between various points along the highways and County Road 3 to the mine site and illustrate that spoil piles would be visible from points D (on I-80) and H (on Highway 72) and along most of County Road 3 between I-80 and Halfway Hill (see Figure 4.8). When the dragline is located in the southwestern portion of the CBCPA, it would also be visible from points D and H. When it is located in the northeastern portion, it would be visible along County Road 3. The mine may also be visible from I-80 approximately 7 mi southeast of the CBCPA. Neither the stockpiles nor the dragline is likely to be visible from the rest area near exit 205 on I-80, the Elk Mountain Interchange, or the Conoco Station.

When viewed from I-80 or Highway 72, spoil piles would appear as large angular features with strong horizontal and diagonal lines on a somewhat angular or rounded landscape with predominately horizontal lines. Newly exposed geologic material would be a different color and slightly brighter than the surrounding landscape. Finally, spoil piles would be devoid of vegetation in a vegetated landscape. The dragline would extend approximately 100 ft above the spoil piles and would appear as a starkly vertical dark feature against a horizontal landscape and a blue/gray sky. It would also stand out as a manmade structure against a relatively undeveloped landscape.

VRM objectives for Class III areas allow moderate changes to the existing landscape although management activities should not dominate the view of the casual observer. Changes should repeat the basic elements of the existing landscape. Because topography would screen the mine for all but 0.5 mi along I-80 and 1.0 mi along Highway 72, the dragline and spoil piles would be visible for 0.5-1.0 minute off to the viewer's side and thus is not likely to dominate the view of a casual observer. Furthermore, most motorists in this area would be looking at Elk Mountain, which is a strikingly scenic feature and on the opposite side of I-80 and thus would draw attention away from the mine. If the spoils and dragline were viewed head-on for several minutes, the mine would dominate the view, but given the circumstances along I-80 and Highway 72 in the mine area, impacts are not expected to be significant.

For off-highway viewers (e.g., travelers on County Road 3, ranchers, recreationists, etc.) in the mine vicinity, the mine would dominate the landscape and thus would significantly impact visual quality. However, the number of viewers would be relatively few.

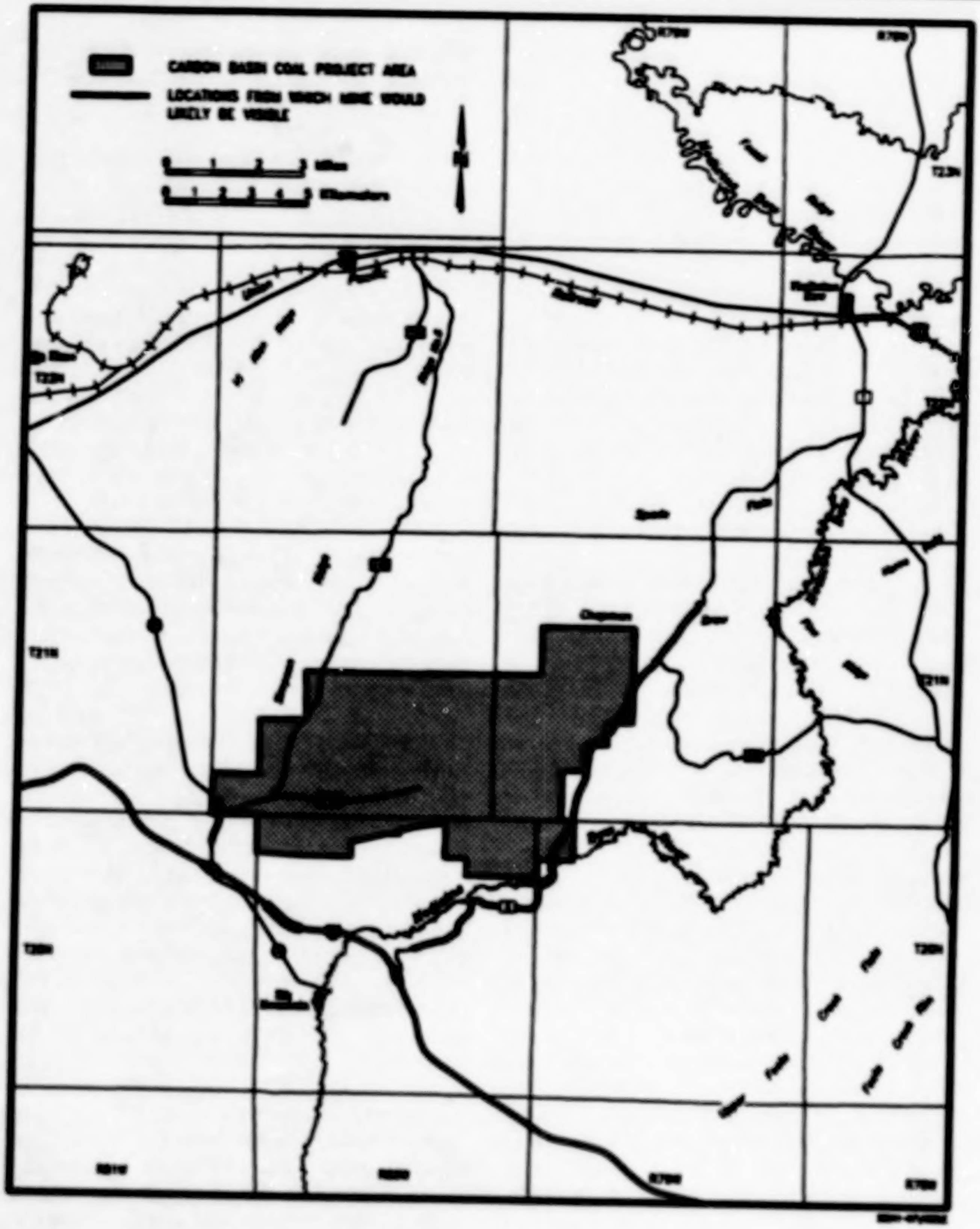
CARBON BASIN COAL PROJECT AREA
LOCATIONS FROM WHICH MINE WOULD LIKELY BE VISIBLE
0 1 2 3 Miles
0 1 2 3 4 5 Kilometers
N
T22N
T21N
T20N
R81W
R80W
R79W
R78W

Figure 4.8 Locations on I-80 and Highway 72 from Which the Mine Likely Would Be Visible.

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Other visual impacts would occur due to dust emissions, increased traffic on Highways 72 and 30/287, and the power line. Dust may also occasionally be visible but would not dominate the landscape for the highway or off-highway viewers and thus visual affects would not be significant. The scenic quality of Highway 72 would be minimally affected by the additional haul truck traffic. Current traffic volumes are quite low and thus the highway is a relatively scenic drive. However, the road is only 12 mi long and thus most motorists would complete the drive in approximately 12 minutes and thus would encounter two or possibly three trucks on-route (assuming that there would be one haul truck every 5 minutes). Visual changes from haul truck traffic would be compatible with VRM Class III objectives and would not constitute a significant impact.

The new power line would be visible from County Road 3 and from other vantages along the corridors. Since the area between Medicine Bow and the CBCPA includes developments such as the Union Pacific Railroad, roads, power lines, a town, traffic, and other manmade features, visual changes created by the railroad and power line would repeat the basic elements of the landscape and thus would be compatible with VRM Class III objectives and would not constitute a significant visual impact.

4.6.2 Proposed Action

Under the Proposed Action, impacts to visual resources would be similar to those described for the No Action Alternative except there would be additional visual impacts associated with the transportation corridors and the amount of time the mine equipment is visible would be increased by 11 years. Impacts under transportation options 1 and 2 would be the same as for the No Action Alternative from 2000 to 2005, after which there would be visual impacts associated with the railroad, but no additional over-the-road haul truck traffic.

Impacts to visual resources due to railroad construction (options 1-8) would be similar to those described for the No Action Alternative except that the new railroad would be visible from County Road 3 and from Medicine Bow, East Allen Lake, and other vantages along the corridor. Visual impacts to the very few off-highway viewers would be significant.

Impacts under the haul road transportation options (4-6) would be similar to those described for the No Action Alternative except that there would be little haul truck traffic on Highway 72, and the new haul road would be visible from Highways 72 and/or 30/287 and possibly the towns of Hanna and Elmo. Construction of route B-1 would create a significant visual impact in the Class III area along Highway 72 because the road and haul truck traffic would dominate the view of motorists on Highway 72. Routes B-2 and B-3 would be most frequently viewed from Highways 72 and 30/287 near Hanna Junction, which is within a VRM Class IV area, so no significant impacts would occur in this area. For off-highway viewers, the haul roads (as well as the mine) could constitute a significant visual impact.

Under the two conveyor options (transportation options 7 and 8), visual resource impacts would be similar to those described for the No Action Alternative except that there would be little haul truck traffic on Highway 72 and the conveyors would add to visual effects. If route C-1 is selected, motorists in the Class III area on Highway 72 would be significantly impacted because the conveyor would dominate the view. Conveyor route C-2 would be viewed most frequently from Highways 72 and 30/287 near Hanna Junction which is a Class IV area; thus impacts from the conveyor in this area would not be significant, but off-highway viewers in Class III areas could be significantly affected. Both routes would be visible from Hanna and Elmo, but both towns are in Class IV areas, and the conveyor would be compatible with existing developments, particularly those associated with mining, in the area.

Under no railroad options (transportation options 9 and 10), the haul road or conveyor would be visible from County Road 3 and adjacent lands and from Medicine Bow, all of which are in Class III areas. In and around Medicine Bow, these facilities would repeat the basic character of the landscape which currently includes buildings, roads, railroads, power lines, etc., so no significant visual effects would occur. For off-highway viewers, visual impacts could be significant depending on location and the distance from which the facility is viewed.

Development of a new coal-handling facility near Medicine Bow would create a significant visual impact because it would stand out as a predominantly industrial facility in a predominantly residential landscape. It would dominate the view of motorists on Highway 30/287 and would not repeat the basic visual elements of the landscape. If transportation options 9 or 10 are approved, there would be no visual impacts from the railroad or from haul truck traffic on Highways 72 and 30/287 for the LOM.

4.6.3 Unavoidable Adverse Impacts

The No Action Alternative and Proposed Action would result in mine development and operations which would begin to dominate or dominate the landscape, depending on the distance from which it is viewed and would not repeat the basic visual elements of the existing landscape. Visual effects of the various transportation corridors, power lines, truck traffic would also impair the scenic quality of the area.

4.6.4 Cumulative Impacts

The southern CIAA is predominantly VRM Class III, the central portion (around Hanna and the existing mines) is Class IV, and the area around Seminoe Reservoir is Class II. For off-highway viewers, the proposed new mines and the SeaWest Wind Plant could dominate the landscape and cause significant visual impacts over approximately 77,770 acres including Foote Creek Rim near Arlington, the CBCPA, and the SeaWest Simpson Ridge project area, depending on the distance from which these developments are viewed. However, much of this area is classified as seldom seen (BLM 1995a)—most viewers would be on I-80 from which these two projects would only be minimally visible. Thus, while the area of impact is large, most viewers would see only a fraction of it.

Other developments including oil, gas, and mineral extraction projects; roads; residences; towns; etc.; contribute to the overall reduction of scenic quality within the CIAA. The existing Medicine Bow Mine permit area overlaps with the VRM Class II area that encompasses Seminoe Reservoir and thus may pose an existing significant impact to some viewers. Some of these developments are and would significantly impact visual quality but are deemed necessary to support public and industry use of public land in conformance with the GDRA RMP/EIS and ultimately FLPMA. Most would be compatible with BLM's management objectives. The Carbon Basin coal project would not effect the visual quality in the VRM Class II area surrounding Seminoe Reservoir.

4.7 HAZARDOUS MATERIALS

4.7.1 No Action Alternative and Proposed Action

Impacts to soils, surface water and groundwater resources, and wildlife could result from accidental hazardous material spills, transformer ruptures, or exposure of wildlife to these materials. Any spills would be cleaned up and the contaminated soils disposed of or rehabilitated as specified in the SPCC Plan. The small amount of soil that potentially could be contaminated, coupled with appropriate and timely cleanup, would result in negligible potential soil impacts from accidental spills. Proper containment of oil and fuel in storage areas and location of facilities away from drainages would limit potential surface and groundwater contamination and preclude any possible wildlife exposure.

Since project operations would comply with all relevant federal and state laws regarding hazardous materials and with directives identified in the Hazardous Materials Management Plan (HMMP) and the SPCC Plan for this project, no significant impact is anticipated.

4.7.2 Cumulative Impacts

All existing development projects within the CIAA use mitigation measures similar to or more stringent than those described for the No Action Alternative and the Proposed Action to prevent soil contamination, surface and groundwater pollution, and wildlife exposure; therefore, impacts are not expected to be significant. Furthermore, since other mines are closing, there could be an overall reduction in the amounts of hazardous materials that are used, transported, and stored within the CIAA.

4.8 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

An irreversible and irretrievable commitment of resources is defined as permanent reduction or loss of a resource that, once lost, cannot be regained. The primary irreversible and irretrievable commitment of resource would include labor, materials, and energy expended during mine development, operation, and reclamation; coal mining and eventual combustion; groundwater consumption by mine equipment and loss via evaporation; surface water loss via evaporation; soil loss through wind and water erosion; loss of productivity (i.e., forage, wildlife habitat) from lands devoted to project activities during the time those lands are out of production and until they are successfully revegetated; inadvertent destruction of paleontological or cultural resources; and accidental animal mortality as discussed in the previous impact analysis.

Energy requirements of the No Action Alternative and Proposed Action are presented in Table 4.18). LOM fuel consumption under the No Action Alternative would be an estimated 12.71 million gallons for mining and reclamation plus an additional 4.87 million gallons for over-the-road coal haulage (Table 4.18). Under the Proposed Action, LOM fuel consumption would be an estimated 40.63 million gallons (a 27.92 million gallon [220%] increase over the No Action Alternative) for mining and reclamation plus an additional 0-33.29 million gallons per year depending on the transportation alternative selected.

Under the No Action Alternative, an estimated 138.00 million kilowatt hours (kwh) would be required over the LOM (Table 4.19). Electricity consumption would be greatest between 2001 to 2007 (approximately 16.20 million kwh/yr). The dragline, estimated to consume 0.7 million kwh/month, would be the greatest consumer of electricity under the No Action Alternative. Electricity consumption for the Archveyor™ (2001-2010) would be approximately 0.3 million kwh/month (personal communication, March 1998, with Ed Turner, Arch). Loadout facilities are estimated to consume 0.15 million kwh/month (1.8 million kwh/yr), and general support facilities are estimated to use 0.2 million kwh/month.

Under the Proposed Action, approximately 354.00 million kwh would be consumed over the LOM (216.00 million kwh more [a 157% increase] than for the No Action Alternative). Consumption at the mine (i.e., excluding transportation options) would be highest between 2005 and 2010 when an estimated 24.00 million kwh/month would be used. Electricity consumption rates for the longwall mining system (2005-2020) and the continuous miners (2004-2020) would be approximately 0.40 million and 0.25 million kwh/month, respectively (personal communication, March 1998, with Ed Turner, Arch). Other facilities would use electricity at rates similar to those described for the No Action Alternative.

Only the conveyor transportation option (options 7, 8, and 10) uses additional electricity, over-and-above the amount required for the

Table 4.18 Estimated Annual Fuel Consumption (Diesel and Unleaded Fuels) for the No Action Alternative and the Proposed Action.

			Proposed Action						
Year	No Action Mine and Reclamation Operations (gal/yr)[a]	No Action Over-the-Road Haulage (gal/yr)[a]	Mine and Reclamation Operations (gal/yr)[a]	Transportation Option(s) 1-2 (gal/yr)[a]	3 (gal/yr)[a]	4-6 (gal/yr)[a,b]	7-8[c]	9 (gal/yr)[a]	10[c]
1999	36,050	72,442	45,657	72,442	0	0	0	0	0
2000	1,070,154	302,516	1,050,659	306,532	54,056	125,012	0	357,459	0
2001	1,553,013	470,050	1,427,307	750,756	125,706	290,742	0	838,650	0
2002	1,572,980	437,995	1,357,421	837,241	144,165	335,720	0	953,770	0
2003	1,611,341	451,134	1,480,115	781,380	130,226	309,267	0	864,591	0
2004	1,620,801	445,127	2,129,070	1,072,939	183,786	427,997	0	1,215,897	0
2005	1,640,302	459,355	2,126,050	1,205,884	224,590	523,800	0	1,485,048	0
2006	1,659,178	444,189	1,875,604	203,156	190,714	404,129	0	1,284,727	0
2007	1,558,645	442,091	2,544,309	390,154	285,711	605,305	0	1,850,215	0
2008	96,142	0	2,430,451	346,453	274,051	650,110	0	1,812,887	0
2009	102,657	0	2,791,479	390,230	325,797	758,780	0	2,155,415	0
2010	117,847	0	858,735	391,334	308,912	742,675	0	2,189,884	0
2011	80,887	0	2,080,453	359,059	266,577	620,797	0	1,703,625	0
2012	36,034	0	2,075,131	351,057	278,615	648,032	0	1,045,267	0
2013	0	0	2,074,230	351,057	278,615	648,032	0	1,045,267	0
2014	0	0	1,978,677	351,057	278,615	648,032	0	1,045,267	0
2015	0	0	1,978,677	351,057	278,615	648,032	0	1,045,267	0
2016	0	0	1,978,677	351,057	278,615	648,032	0	1,045,267	0
2017	0	0	1,978,677	351,057	278,615	648,032	0	1,045,267	0
2018	0	0	1,978,677	351,057	278,615	648,032	0	1,045,267	0
2019	0	0	1,978,677	351,057	278,615	648,032	0	1,045,267	0
2020	0	0	1,978,677	351,057	278,615	648,032	0	1,045,267	0
2021	0	0	134,427	0	0	0	0	0	0
2022	0	0	117,413	0	0	0	0	0	0
2023	0	0	106,120	0	0	0	0	0	0
Estimated LOM Total Fuel Use (gal)	12,713,346	4,205,957	40,620,479	10,450,206	3,851,747	11,717,825	0	23,285,591	0

[a] Assumes medium fuel usage for a: Cat 651E Scraper @ 15 gal/hr, Cat 130G Grader @ 5 gal/hr, Cat 988B @ 12 gal/hr, Cat D[illegible] @ 17 gal/hr (Caterpillar Inc. 1989); 1,300-horsepower (hp) @ 20 gal/hr (personal communication, March 1998, with Ed Turner, Arch); 300- to 400-hp diesel h[illegible] trucks @ 9.6 gal/hr (personal communication, March 1998, with Ed Turner, Arch); 1,800-hp diesel CAT 789 Electromotive @ 32 gal/hr (personal communication, February 1998, with Cliff Cole, TRC Environmental Corporation).

[b] Estimates computed using the longest haul route.

[c] Transportation Options 7-8 and 10 are the conveyor, which uses electricity rather than fuel. The conveyor will consume 72,000 kWh/day (assuming a 48-inch belt traveling 700 ft/min moving 1,000 tons/hr, 15 hrs per day).

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Table 4.19 LOM Estimated Electricity Requirements for the No Action Alternative and Proposed Action.[1]

Year	No Action Alternative[2] (thousand kwh)	Proposed Action[3] (thousand kwh)	Transportation Options 7 and 8[4] (thousand kwh)	Transportation Option 10[5] (thousand kwh)
1999	2,400	2,400	0	0
2000	12,600	12,600	25,920	25,920
2001	16,200	16,200	25,920	25,920
2002	16,200	16,200	25,920	25,920
2003	16,200	16,200	25,920	25,920
2004	16,200	19,200	25,920	25,920
2005	16,200	24,000	25,920	25,920
2006	16,200	24,000	0	25,920
2007	16,200	24,000	0	25,920
2008	2,400	24,000	0	25,920
2009	2,400	24,000	0	25,920
2010	2,400	24,000	0	25,920
2011	2,400	12,000	0	25,920
2012	–	12,000	0	25,920
2013	–	12,000	0	25,920
2014	–	12,000	0	25,920
2015	–	12,000	0	25,920
2016	–	12,000	0	25,920
2017	–	12,000	0	25,920
2018	–	12,000	0	25,920
2019	–	12,000	0	25,920
2020	–	12,000	0	25,920
2021	–	2,400	0	0
2022	–	2,400	0	0
2023	–	2,400	0	0
Total	138,000	354,000	155,520	544,320

Table 4.19 (Continued)

[1] Source: The data used to make these calculations are presented below; kwh use for various types of equipment were obtained via personal communication, March 1998, with Ed Turner, Arch.

[2] Totals based on the following: conveyor: 2.16 million kwh/month, 2000-2020.

[3] Totals based on the following: Dragline: 0.7 million kwh/month, 2000-2007; Archveyor™: 0.3 million kwh/month, 2001-2007; loadout: 0.15 million kwh/month, 2000-2007; general support: 0.2 million kwh/month, 1999-2011.

[4] Totals based on the following: Dragline: 0.7 million kwh/month, 2000-2010; Archveyor™: 0.3 million kwh/month, 2001-2020; continuous miner: 0.25 million kwh/month, 2005-2020; longwall mining system: 0.4 million kwh/month, 2004-2020; loadout: 0.15 million kwh/month, 2000-2020; general support: 0.2 million kwh/month, 1999-2023.

[5] Totals based on the following: conveyor: 2.16 million kwh/month, 2000-2005.

Proposed Action. Under options 7 and 8, an additional 155.52 million kwh would be consumed; under option 10, an additional 544.32 million kwh would be consumed.

4.9 SHORT-TERM USE OF THE ENVIRONMENT VS. LONG-TERM PRODUCTIVITY

For the purposes of this discussion, short-term use of the environment is that use during the LOM, whereas long-term productivity refers to the period after mine closure and reclamation. Short-term use of the environment would not significantly affect long-term productivity within or adjacent to the CBCPA or along the transportation corridors. During mine operations and after mine closure, the same resources that were present prior to the project would be available, except for coal. It may take hundreds of years for aquifers to recharge and tens of years for reclaimed areas to successfully revegetate with shrub productivity comparable to premine levels; however, backfilling and reclamation would provide conditions to support wildlife, livestock, and recreation. Use of the project area during the LOM would not preclude the subsequent long-term productivity of the area for approved postmining land uses.

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5.0 MITIGATION AND MONITORING

Sections 5.1, 5.2, and 5.3 in this chapter reproduce in their entirety WDEQ's performance standards for surface and underground mines and BLM's requirements and mitigation. These standards, requirements, and mitigation were developed specifically for the purpose of environmental protection and Arch would be required to comply with all of the applicable requirements. These regulations and guidelines have been reproduced because they provide the details of mitigation and monitoring required for this project but they may not be readily available to the public or other EIS reviewers for whom proposed mitigations must be fully disclosed.

5.1 WDEQ ENVIRONMENTAL PROTECTION PERFORMANCE STANDARDS FOR SURFACE COAL MINING OPERATIONS

5.1.1 General

This section (5.1) sets forth the environmental protection performance standards applicable to all coal mining operations. No mining operation shall be conducted except in compliance with the requirements hereof.

5.1.2 General Environmental Protection Performance Standards

5.1.2.1 Land Uses

Reclamation. Reclamation shall restore the land to a condition equal to or greater than the "highest previous use." The land, after reclamation, must be suitable for the previous use which was of the greatest economic or social value to the community area, or must have a use which is of more economic or social value than all of the other previous uses.

Habitat. Operators are required to restore wildlife habitat, whenever the Administrator determines that this restoration is possible, on affected land in a manner commensurate with or superior to habitat conditions which existed before the land became affected, unless the land is private and the proposed use is for a residential or agricultural purpose which may preclude its use as wildlife habitat.

Recreational Water. Water impoundments used for recreational purposes shall be constructed in accordance with the statutes and Section 5.1.2.7. Recreational lands, other than water impoundments, represent changes in the land which may or may not be suitable for wildlife habitat.

5.1.2.2 Backfilling, Grading and Contouring

Rough Backfilling and Grading. Rough backfilling and grading shall follow coal removal as contemporaneously as possible based upon the mining conditions. The operator shall include within the application for a permit to mine a proposed schedule for backfilling and grading with supporting analysis.

Material Replacement. Backfilled materials shall be replaced in a manner which minimizes water pollution on and off the site and supports the approved postmining land use. Preparation of final graded surfaces shall be conducted in a manner that minimizes erosion and provides a surface for replacement of topsoil that will minimize slippage.

Contouring. All affected lands shall be returned to their approximate original contour, except as authorized by a variance or exemption under Chapter 5, Sections 6 and 7, or Chapter 8, or Chapter 9 of the WDEQ *Coal Rules and Regulations*.

Spoil. All spoil shall be transported, backfilled, compacted (where necessary to insure stability or to prevent leaching) and graded to eliminate all highwalls, spoil piles, and depressions, except that:

- soil conservation techniques may be employed if they are needed to retain moisture, minimize erosion, create and enhance wildlife habitat, and assist revegetation;
- incomplete elimination of highwalls may be authorized in accordance with Chapter 5, Section 7 of WDEQ *Coal Rule and Regulations*.
- spoil may be placed on an area outside the mined-out area to restore the approximate original contour by blending the spoil into the surrounding terrain if the spoil is backfilled and graded on the area in accordance with the requirements of this subsection (5.1.2.2).

Slopes. Postmining slopes shall not exceed a slope necessary to achieve a minimum long-term static safety factor of 1.3, to prevent slides and restore stable drainages and hillslopes.

Thin Overburden. Where surface coal mining operations are proposed to be carried out continuously in the same limited pit area for more than 1 year from the day coal removal operations begin and where the volume of all available spoil and suitable waste materials over the life of the mine is demonstrated to be insufficient to achieve the approximate original contour considering bulking factor and coal removal, surface mining activities shall be conducted to use all available spoil and suitable waste materials to attain the lowest practicable stable grade, but not more than the angle of repose, and to meet the requirements of the paragraphs concerning material replacement and spoil, above.

Thick Overburden. Where the volume of spoil over the life of the mine is demonstrated to be more than sufficient to achieve the approximate original contours considering bulking factor, coal removal and subsidence of backfilled material, excess spoil may be placed outside the pit area in accordance with the requirements of Section 5.1.2.3

Permanent Impoundments. Where permanent impoundments are authorized in accordance with Chapter 2, Section 2(b)(xiv) of the WDEQ *Coal Rules and Regulations*, spoil that may result from the impoundment will be handled in accordance with the requirements of this section (5.1.2.2).

Soft Rock Surface Mining. If the reclamation plan does not provide for a permanent water impoundment, the final pit area shall be backfilled, graded, compacted, and contoured to the extent necessary to return the land to the use specified in the approved plan. In preparation of slope specifications in the plan, the operator shall consider an average of the measured slopes in the immediate area of the proposed mine site. Slopes in the reclaimed area shall approximate the premining slopes. Individual slope measurements, locations of the measurements, and the average measurement shall be submitted with the reclamation plan. In determinations of the approximate premining slope, the WDEQ-Land Quality Division may make an independent slope survey. All backfilling, grading, and contouring will be done in such a manner so as to preserve the original drainage or provide for approved adequate substitutes. No depressions to accumulate water will be permitted unless approved in the reclamation plan as being consistent with the proposed future use of the land.

Terraces or benches may be used only when it can be shown to the Administrator's satisfaction that other methods of contouring will not provide the required result. If terracing is proposed, detailed plans indicating the dimensions and design of the terraces, check dams, any erosion prevention techniques, and slopes of the terraces and their intervals will be required.

If the reclamation plan provides for a permanent water impoundment and this use has been approved according to the requirements outlined in the *Wyoming Environmental Quality Act* (WS 35-11-101 through 35-11-104) and the WDEQ *Coal Rules and Regulations*, the exposed pit areas must be sloped, graded, and contoured so as to blend in with the topography of the surrounding terrain and provide for access and revegetation. Riprapping where necessary to prevent erosion will be required. Sloping requirements will be as described above. Under certain conditions wherein it can be demonstrated to the Administrator's satisfaction that the pitwall can be stabilized by terracing or other techniques it may be permissible to leave not more than one-half of a proposed shoreline composed of the stabilized pitwall. The remaining portion of the shoreline must be graded and contoured so as to provide access and blend in with the topography of the surrounding terrain. In the event that a partial pitwall is proposed as final reclamation, the operator must submit a detailed explanation of the techniques to be used to establish the stability of the pitwalls in his reclamation plan. At the Administrator's discretion, a study of the proposed pitwall stabilization techniques may be required from an independent engineering company for purposes of verifying the effectiveness of the proposed stabilization techniques. The WDEQ-Land Quality Division will determine the acceptability of the proposed stabilization techniques based on this information and an on-site inspection.

Highwall retention may be considered on a case-by-case basis for enhanced wildlife habitat. The WGFD shall be consulted by the applicant for need and design of the land form. Any approval under this paragraph shall be based on a demonstration of safety, stability, environmental protection, and equal or better land use considerations.

5.1.2.3 Topsoil, Subsoil, Overburden, and Refuse

Topsoil. All topsoil or approved surface material shall be removed from all areas to be affected in the permit area prior to these areas being affected unless otherwise authorized by the Administrator. The topsoil may be mixed with the subsoil but shall be segregated so as not to become mixed with spoil or waste material, stockpiled in the most advantageous manner and saved for reclamation purposes. The Administrator may authorize topsoil to remain on areas where minor disturbance will occur associated with construction and installation activities including but not limited to light-use roads, signs, utility lines, fences, monitoring stations and drilling provided that the minor disturbance will not destroy the protective vegetative cover, increase erosion, nor adversely affect the soil resource.

When topsoil is not promptly redistributed, the topsoil or approved surface material shall be stockpiled on stable areas within the permit area in such a manner so as to minimize wind and water erosion and unnecessary compaction. In order to accomplish this, the operator shall establish, through planting or other acceptable means, a quick growing cover of vegetation on the topsoil stockpiles. The topsoil shall also be protected from acid or toxic materials, and shall be preserved in a usable condition for sustaining vegetation when placed over affected land. Provided however, where long-term disturbance will occur, the Administrator may authorize the temporary distribution of topsoil to enhance stabilization of affected lands within the permit area. Where this is authorized, the Administrator shall find that the topsoil or subsoil capacity and productive capabilities are not diminished, that the topsoil is protected from erosion, and will be available for reclamation.

Reclamation shall follow mining as soon as is feasible so as to minimize the amount of time topsoil must be stockpiled. Where topsoil has been stockpiled for more than 1 year, the operator may be required to conduct nutrient analyses to determine if soil amendments are necessary.

Topsoil stockpiles shall be marked with a legible sign containing letters not less than six inches high on all approach roads to such stockpiles. Said signs shall contain the word "Topsoil" and shall be placed not more than 150 ft from any and all stockpiles of topsoil. Such signs must be in place at the time stockpiling is begun.

If abundant topsoil is present, and it is not all needed to accomplish the reclamation required in the approved reclamation plan, the Administrator may approve of use of this topsoil by this or another operator in another area for reclamation purposes.

Trees, large rocks and other waste material which may hinder redistribution of topsoil shall be separated from the topsoil before stockpiling.

Subsoil. Except as provided below, all subsoil determined by field methods or chemical analysis to be suitable as a plant-growth medium shall be removed from all areas to be affected and handled in accordance with the topsoil requirements of this section (5.1.2).

Upon an adequate demonstration by the operator that all or a portion of the subsoil material is not needed to meet the revegetation and land use requirements of the WDEQ *Coal Rules and Regulations*, the Administrator may authorize all or a portion of the subsoil to not be used for reclamation. The unused subsoil may then be regarded as overburden material and handled in accordance with the requirements of this section (5.1.2).

Soil Horizons. The topsoil (A and E horizons) shall be segregated from the subsoil (B and C horizons) where the Administrator determines that this practice is necessary to achieve the revegetation requirements of the WDEQ *Coal Rules and Regulations*.

Redistribution. Before redistribution of topsoil or subsoil the regraded land shall be treated, if necessary, to reduce potential for slippage and encourage root penetration.

Substitution. Topsoil, subsoil, and/or an approved topsoil substitute shall be redistributed in a manner that:

- achieves an approximate uniform, stable thickness consistent with the approved permit and the approved postmining land uses, contours and surface water drainage system;
- prevents compaction which would inhibit water infiltration and plant growth;
- protects the topsoil from wind and water erosion before and after it is seeded until vegetation has become adequately established; and
- conserves soil moisture and promotes revegetation.

Rills and Gullies. All rills and gullies which either preclude achievement of the approved postmining land use or the reestablishment of the vegetative cover, or cause or contribute to a violation of water quality standards for the receiving stream, shall be regraded or otherwise stabilized. Topsoil shall be replaced and the areas shall be reseeded or replanted.

Soil Testing. Nutrients and soil amendments in the amounts determined necessary by soil test or field trials shall be applied to the replaced topsoil, subsoil or substitute material so that adequate nutrient levels are available to establish the vegetative cover. Fertilizer shall be applied at appropriate seasons and in amounts that will minimize pollution of surface waters or groundwaters.

Impoundments. The Administrator may not require topsoil or subsoil replacement on structures or within impoundments where replacement of this material is inconsistent with the intended use and the structures are otherwise stable.

Spoil Material. If a sufficient volume of suitable topsoil or subsoil is not available for salvage or redistribution, then selected spoil material may be used as a topsoil or subsoil substitute or supplement. The operator shall demonstrate that the resulting plant growth medium is equal to, or more suitable for sustaining vegetation than the existing topsoil or subsoil and that it is the best available in the permit area to support revegetation. A demonstration of the suitability of the substitutes or supplements shall be based upon analysis of the texture, percent coarse fragments and pH. The Administrator may require other chemical and physical analyses, field site trials, or greenhouse tests if determined to be necessary or desirable to demonstrate the suitability of the topsoil or subsoil substitutes or supplements.

Topsoil and Subsoil Substitutes. Topsoil substitute stockpiles shall be segregated from topsoil and overburden piles and shall be identified as substitute material. Identification signs shall be placed not more than 150 ft from all stockpiles of substitute material. Such signs shall be in place at the time stockpiling is begun.

If overburden is to be used in reclamation as a substitute for topsoil, all large rocks and other waste material which may hinder redistribution shall be separated before stockpiling.

Overburden, Spoil and Refuse. All overburden, spoil material and refuse shall be segregated from the topsoil and subsoil and stockpiled in such a manner to facilitate the earliest reclamation consistent with the approved reclamation plan.

Except where diversions are authorized by the WDEQ *Coal Rules and Regulations*, all overburden, spoil material, and refuse piles must be located to avoid blocking intermittent or perennial drainages and flood plains in order to minimize loss and spread of material due to water erosion. Ephemeral drainages may be blocked if environmentally sound methods for dealing with runoff control and sedimentation are approved by the Administrator. For temporary stockpiles, material should be replaced in pits as soon as possible consistent with the approved reclamation plan to minimize the amount of time material is stockpiled.

All topsoil shall be removed from areas to be used for piling spoil material prior to the beginning of piling this material.

The operator may be required to have analyses made of spoil material in order to determine if it will be a source of water pollution through reaction with leaching by surface water. If it is determined that this condition may exist, the operator shall describe proposed procedures for eliminating this condition.

All overburden and spoil material that is determined to be toxic, acid-forming or will prevent adequate reestablishment of vegetation on the reclaimed land surface, unless such materials occur naturally on the land surface, must be properly disposed of during the mining operation.

All excess spoil shall be placed in approved excess spoil disposal sites located within the permit area. If permanent overburden, spoil, or refuse piles have been approved by the Administrator, they shall be:

- located on moderately sloping and naturally stable areas where placement provides for stability and prevents mass movement;
- located in areas which do not contain springs, seeps, natural or man-made drainages (excluding rills and gullies), croplands, or important wildlife habitat;
- designed, graded and contoured so as to blend in with the topography of the surrounding terrain. Excess spoil pile sites shall not be located on an overall slope that exceeds 20 degrees unless keyway cuts (excavations to stable bedrock), rock toe buttresses or other special structural provisions are constructed to ensure fill stability. The operator must demonstrate to the satisfaction of the Administrator that this material will be stable and can be revegetated as required by this section (5.1.2); and
- the slopes of all spoil areas must be designed so that they will be stabilized against wind and water erosion. After the grading and contouring of these stockpiles, topsoil or approved subsoil must be distributed over them in preparation for the revegetation procedure. Revegetation

must be completed in accordance with requirements of this section (5.1). A permanent drainage system must be established consistent with the WDEQ *Coal Rules and Regulations*.

Excess spoil may be returned to underground mine workings in accordance with the plan approved by the Administrator and by MSHA.

Excess spoil piles shall be designed using current, prudent professional standards and certified by a qualified registered professional engineer. All piles shall be designed and constructed in accordance with the standards of this section (5.1.2.3). Special structural provisions shall be designed using prudent current engineering practices, in accordance with Chapter 2, Section 2(b)(xviii)(E) of the WDEQ *Coal Rules and Regulations*.

Excess spoil shall be placed in a controlled manner to:

- prevent pollution from leachate and surface runoff from the fill on surface water or groundwater of the State;
- ensure mass stability and prevent mass movement during and after construction and provide for stable drainages and hillslopes; and
- ensure that the land mass designated as the disposal site is suitable for reclamation and revegetation compatible with the natural surroundings and approved postmining land use.

The spoil pile shall be transported and placed in horizontal lifts in a controlled manner, concurrently compacted as necessary to ensure mass stability and prevent mass movement, covered, and graded to allow surface and subsurface drainage to be compatible with the natural surroundings and ensure a minimum long-term static safety factor of 1.5. The Administrator may limit the horizontal lifts to 4 ft or less as necessary to ensure the stability of the fill or to meet other applicable requirements.

No water impoundments or large depressions shall be constructed on the fill. Soil conservation techniques may be approved if they are needed to minimize erosion, enhance wildlife habitat or assist revegetation, as long as they are not incompatible with the stability of the fill.

The foundation and abutments of the fill shall be stable under all conditions of construction. Sufficient foundation investigation and any necessary laboratory testing of foundation materials shall be performed in order to determine the design requirements for foundation stability. Analyses of foundation conditions shall include the effect of underground mine workings, if any, upon the stability of the structure.

Slope protection shall be provided to minimize surface erosion at the site. Diversion of surface water runoff shall conform with the requirements of Section 5.1.2.5 below. All disturbed areas, including diversion ditches that are not riprapped, shall be vegetated upon completion of construction.

Terraces may be constructed on the outslope of the fill if required for stability, control of erosion, to conserve soil moisture, or to facilitate the approved postmining land use. The grade of the outslope between terrace benches shall not be steeper than 2h:1v (50 percent).

Excess spoil that is toxic, acid-forming or combustible shall be adequately covered with suitable material or treated to prevent pollution of surface and groundwater, to prevent sustained combustion, and to minimize adverse effects on plant growth and the approved postmining land use.

The Administrator may specify additional design criteria on a case-by-case basis as necessary to meet the general requirements of this section (5.1.2.3).

The fill shall be inspected for stability by a qualified registered professional engineer or other qualified professional specialist under the direction of a professional engineer experienced in the construction of earth and rockfill embankments at least quarterly throughout construction and during the following critical construction periods: (1) foundation preparation, including the removal of all organic material and topsoil, (2) placement of diversion systems, (3) installation of final surface drainage systems, and (4) final grading and revegetation. Regular inspections by the engineer or specialist shall be conducted during placement and compaction of the fill materials. The registered professional engineer shall promptly provide certified reports to the Administrator which demonstrate that the fill has been maintained and constructed as specified in the design contained in the approved mining and reclamation plan. The report shall discuss appearances of instability, structural weakness, and other hazardous conditions. A copy of all inspection reports shall be retained at the mine site.

Coal Mine Waste. Coal mine waste shall be disposed only in existing or, if new, in an approved disposal site within a permit area. Coal mine wastes shall not be used in the construction of dams, embankments, or diversion structures. The disposal area shall be designed, constructed and maintained:

- in accordance with the excess spoil disposal requirements described above for overburden, spoil, and refuse handling; and
- to prevent combustion and not create a public health hazard.

Disposal of coal mine waste in excess spoil piles may be approved if such waste is:

- placed in accordance with the excess spoil requirements described above for overburden, spoil, and refuse handling;
- demonstrated to be nontoxic and nonacid-forming (or properly treated); and
- demonstrated to be consistent with the design stability of the fill.

In addition, coal mine waste piles shall meet the following requirements:

- the disposal facility shall be designed to attain a minimum static safety factor of 1.5. The foundation and abutments must be stable under all conditions of construction;
- following final grading of the waste pile, the site shall be covered with a minimum of 4 ft of the best available, nontoxic, nonacid-forming and noncombustible material, in a manner that directs runoff away from the waste pile. The site shall be revegetated in accordance with this section (5.1). The Administrator may allow less than 4 ft of cover material based on physical and chemical analyses which show that the revegetation requirements will be met;
- surface drainage from above the pile and from the crest and face of the pile shall be permanently diverted around the waste in accordance with Section 5.1.2.5;
- all coal mine waste piles shall be inspected in accordance with the excess spoil requirements of described above. More frequent inspections shall be conducted if a danger or harm exists to the public health and safety or the environment. Inspections shall continue until the waste pile has been finally graded and revegetated or until a later time as required by the Administrator. If any inspection discloses that a potential hazard exists, the Administrator shall be notified immediately, including notification of any emergency protection and remedial procedures which will be implemented. If adequate procedures cannot be formulated or implemented, the Administrator shall inform the appropriate emergency agencies of the hazard to protect the public from the area; and
- all coal mine waste piles shall meet the requirements of 30 CFR 77.214 and 77.215.

Dams and embankments constructed to impound coal mine waste shall comply with the following:

- each impounding structure shall be designed, constructed and maintained in accordance with the requirements applicable to temporary impoundments. Such structures may not be retained permanently as part of the approved postmining land use. Approval by the Wyoming State Engineer's Office is not required;
- if the impounding structure meets the criteria of 30 CFR 77.216(a), the combination of principal and emergency spillways shall be able to safely pass the 100-year, 6-hour design precipitation event or a storm duration having a greater peak flow;
- spillways and outlet structures shall be designed to provide adequate protection against erosion and corrosion. Inlets shall be protected against blockage.
- be designed so that 90 percent or more of the water stored during the design precipitation event can be removed within ten days; and
- runoff from areas above the disposal facility or runoff from the surface of the facility that may cause instability or erosion of the impounding structure shall be diverted into stabilized diversion channels designed to meet the requirements for diversions, and designed to safely pass the runoff from a 100-year, 6-hour design precipitation event or a storm duration having a greater peak flow.

The *Administrator* may specify additional design criteria for waste piles or impounding structures on a case-by-case basis as necessary to meet the general performance standards of this section (5.1.2.3).

Coal mine waste fires shall be extinguished by the operator in accordance with a plan approved by the *Administrator* and the Mine Safety and Health Administration. The plan shall contain, at a minimum, provisions to ensure that only those persons authorized by the operator, and who have an understanding of the procedures to be used, shall be involved in the extinguishing operations. No burning or burned coal mine waste may be removed from a permitted disposal area without a removal plan approved by the *Administrator*. Consideration shall be given to persons working or living in the vicinity of the structure.

Coal preparation plants shall be included within a permit area. Refer to Chapter 3, Section 6 of the WDEQ *Coal Rules and Regulations* for requirements applicable to coal preparation plants.

Acid-forming and Toxic Materials, and Other Waste. All exposed coal seams remaining after mining and any acid-forming, toxic, and combustible materials, or any waste materials that are exposed, used or produced during mining shall be adequately covered, within 30 days of its exposure with nontoxic, nonacid-forming and noncombustible material, or treated. Compaction followed by burial or treatment shall be provided to prevent pollution of surface and groundwater quality, prevent sustained combustion and to minimize adverse effects on plant growth and postmining land uses. Such materials may be stored in a controlled manner until final burial and/or treatment first becomes feasible as long as storage will not result in any risk of water pollution or other environmental or public health and safety damage. Storage, final burial and treatment shall be done in accordance with all local, state and federal requirements.

Acid-forming or toxic material, or any other waste material capable of polluting water, shall not be buried or stored in the proximity of a drainage channel or its flood plain so as to cause or pose a threat of water pollution.

Final burial of noncoal mine waste materials (such as grease, lubricants, paints, flammable liquids, garbage, trash, abandoned mining machinery, lumber and other combustible materials) and any wastes classified as hazardous shall be in a designated disposal site authorized by the Solid Waste Management Section of the Department.

Management and final burial on the permit area of solid wastes generated by a mine mouth power plant or mine mouth coal drier shall be in accordance with this section (5.1.2) and with provisions of the Solid Waste Management Rules and Regulations deemed appropriate by the Administrator.

5.1.2.4 Revegetation

Vegetative Cover. The operator shall establish on all affected lands a diverse, permanent vegetative cover of the same seasonal variety native to the area or a mixture of species that will support the approved postmining land use in a manner consistent with the approved reclamation plan. This cover shall be self-renewing and capable of stabilizing the soil.

Non-vegetated Lands. Land which did not support vegetation prior to becoming affected land because of natural soil conditions need not be revegetated unless subsoil from such affected land will support vegetation. The operator shall demonstrate to the Administrator's satisfaction that revegetation or reforestation is not possible if he seeks to proceed under the provisions of the subsection.

Time of Revegetation. After backfilling, grading, and contouring and the replacement of topsoil, and/or approved substitutes, revegetation shall be commenced in such a manner so as to most efficiently accommodate the retention of moisture and control erosion on all affected lands to be revegetated. In addition, any fertilizer requirements as determined on the basis of previous analysis must be fulfilled.

Mulching. Mulch or other equivalent procedures which will control erosion and enhance soil moisture conditions shall be used on all retopsoiled areas.

Seeding. Seeding which is accomplished by mechanical drilling shall be on the topographic contour, unless for safety reasons it is not practicable, or perpendicular to the prevailing wind on flat areas. Seeding of affected lands shall be conducted during the first normal period for favorable planting conditions after final preparation unless an alternative plan is approved. Any rills or gullies that would preclude successful establishment of vegetation or achievement of postmining land use shall be removed or stabilized. The species of vegetation to be used in revegetation efforts shall be described in the reclamation plan indicating the composition of seed mixtures and the amount of seed to be distributed on the area on a per acre basis. Seed types will depend on the climatic and soil conditions prevailing in the permit area and the proposed use of the land after reclamation. Species to be planted as permanent cover shall be self-renewing. Seeding rates will depend on seed types, climatic and soil conditions and the techniques to be used in seeding.

Introduced Species. Introduced species may be used only to achieve a quick, temporary, stabilizing cover to control erosion, or to achieve a postmining land use as approved by the Administrator. Naturalized or nonindigenous native plant species may be included in the approved seed mixture if they support the approved postmining land uses. The operator shall document, unless otherwise authorized by the Administrator, the suitability of these species using data from published literature, from experimental test plots, from on-site experience, or from other information sources.

Postmining Land Use Considerations. When the approved postmining land use is for residential, industrial/commercial, or cropland, the reclaimed area shall be stabilized and revegetated to control erosion unless development or cropping shall immediately occur.

Previously Disturbed Areas. For areas previously disturbed by mining and not reclaimed to the requirements of the WDEQ *Coal Rules and Regulations*, the areas shall, at a minimum, be revegetated to a ground cover and productivity level existing before redisturbance and shall be adequate to control erosion.

Bond Release. The bond for revegetation shall be retained for not less than 10 years after the operator has completed seeding, fertilizing, irrigation, or other work to ensure revegetation. The bonding period shall not be affected where normal and reasonably good husbandry practices are being followed. The success of revegetation shall be determined in accordance with this section (5.1.2.4). If the Administrator approves an alternative success standard, as allowed by this section (5.1.2.4), the standard shall be based on technical information obtained from a recognized authority (e.g. Soil Conservation Service, Agricultural Research Service, Universities, WGFD, USFWS, etc.), or be supported by scientifically valid research. Use of an alternative technical standard shall be supported by concurrence from state and federal agencies having an interest in management of the affected lands.

Operator Completion. The Administrator shall not release the entire bond of any operator until such time as revegetation is completed, if revegetation is the method of reclamation as specified in the operator's approved reclamation plan. Revegetation shall be deemed to be complete when: (1) the vegetation cover of the affected land is shown to be capable of renewing itself under natural conditions prevailing at the site, and the vegetative cover and total ground cover are at least equal to the cover on the area before mining, (2) the productivity is at least equal to the productivity on the area before mining, (3) the species diversity and composition are suitable for the approved postmining land use and the revegetated area is capable of withstanding grazing pressure at least comparable to that which the land could have sustained prior to mining, unless federal, state or local regulations prohibit grazing on such lands, and (4) the requirements in (1), (2), and (3) are met for the last 2 consecutive years of the bonding period. The Administrator shall specify quantitative methods and procedures for determining whether equal cover and productivity has been established including, where applicable, procedures for evaluating postmining species diversity and composition. The following options or an alternative success standard approved by the Administrator are available.

- The method utilizing control areas may be selected. If selected, the control areas shall be sampled for cover, productivity, species diversity and composition in the same season that the area to be affected is sampled for baseline data. Quantitative premining and postmining vegetation data from the control areas shall be used to mathematically adjust premining affected area data for climatic change. Premining affected area cover and productivity data will be directly compared by statistical procedures to data from the reclaimed vegetation type when evaluating revegetation success for final bond release. Species diversity and composition data will be qualitatively or quantitatively evaluated as determined by the Administrator.

- The method utilizing reference areas may be selected. If selected, the representativeness of the reference area is verified by a statistical comparison to the plant community that it typifies. Postmining cover and productivity data from the reference area are directly compared by standard statistical procedures to data from the reclaimed area when evaluating revegetation success for final bond release. Species diversity and composition data will be qualitatively or quantitatively evaluated as determined by the Administrator.

- Where the premining cover, productivity, species diversity and composition data cannot be collected, or where the area to be affected is small and incidental to the operation, comparison areas may be selected. For purposes of this method, postmining qualitative and quantitative data from the comparison area are directly compared by procedures acceptable to the Administrator to data from the reclaimed lands when evaluating success of revegetation for final bond release.

- Without regard to the type of method selected, control, reference or comparison areas should be at least two acres in size, located in areas where they will not be affected by future mining, while serving their designated use, managed in a fashion which will not cause significant changes in the vegetation parameters of cover, productivity, species diversity and composition and be representative of the postmining land use.

- The postmining density, composition, and distribution of shrubs shall be based upon site-specific evaluation of premining vegetation and wildlife use. Shrub reclamation procedures shall be conducted through the application of best technology currently available.

  - Except where a lesser density is justified from premining conditions in accordance with Appendix A of the WDEQ *Coal Rules and Regulations*, at least 20 percent of the eligible lands shall be restored to shrub patches supporting an average density of one shrub per square meter. Patches shall be no less than .05 acres each and shall be arranged in a mosaic that will optimize habitat interspersion and edge effect. Criteria and procedures for establishing the standard are specified in Appendix A of the WDEQ *Coal Rules and Regulations*. This standard shall apply to all lands affected after August 6, 1996.

  - Approved shrub species and seeding techniques shall be applied to all remaining grazing land. Trees shall be returned to a density equal to the premining conditions.

  - For areas containing crucial habitat, designated as such prior to the submittal of a permit application or any subsequent amendment, or critical habitat the WGFD shall be consulted above, and its approval shall be required for, minimum stocking and planting arrangements of shrubs, including species composition. For areas determined to be important habitat, the WGFD shall be consulted for recommended minimum stocking and planting arrangements of shrubs, including species composition, that may exceed the programmatic standard discussed above.

- Where trees are part of the approved reclamation plan, at the time of bond release the trees to meet the required stocking rate shall be healthy, and at least 80 percent shall have been planted for at least 8 years.

- Standards for the success of reforestation for commercial harvest shall be established in consultation with forest management agencies and prior to approval of any mining and reclamation plan that proposes reforestation. If reforestation for commercial harvest is the method of revegetation, reforestation shall be deemed to be complete when a reasonable population density as established in the reclamation plan has been achieved, the trees have shown themselves capable of continued growth for a minimum period of 5 years following planting, and the understory vegetation is adequate to control erosion and is appropriate for the land use goal. Quality and quantity, vegetation cover, productivity, and species diversity shall be determined in accordance with scientifically acceptable sampling procedures approved by the *Administrator*.

- If the *Administrator* approves a long-term, intensive agricultural postmining land use, the 10-year period of liability shall commence at the date of initial planting for such long-term agricultural use.
- When the approved reclamation plan is to return to cropland, reclamation shall be deemed to be complete when productive capability is equivalent, for at least 2 consecutive crop years, to the premining conditions or approved reference areas. The premining production data for the reclaimed site shall be considered in judging completeness of reclamation whenever said data are available.

Monitoring. Monitoring of permanent revegetation on reclaimed areas before and after grazing shall be conducted at intervals throughout the period prior to bond release in accordance with the plan required by Chapter 2, Section 2(b)(vii) of WDEQ *Coal Rules and Regulations*. Monitoring results shall be presented in the annual report.

Irrigation. Any plans for irrigation must be explained.

Protection from Livestock. The operator must protect young vegetative growth from being destroyed by livestock by fencing or other approved techniques for a period of at least 2 years, or until the vegetation is capable of renewing itself with properly managed grazing and without supplemental irrigation or fertilization. The Administrator, permittee and the landowner or land managing agency shall determine when the revegetated area is ready for livestock grazing.

Noxious Weeds. In those areas where there were no or very few noxious weeds prior to being affected by mining, the operator must control and minimize the introduction of noxious weeds into the revegetated areas for a period of at least 5 years after the initial seeding.

5.1.2.5 Diversion Systems and Drainage Control

Diversion of Streams. All diversions shall be designed to assure public safety, prevent material damage outside the permit area, and minimize adverse impacts to the hydrologic balance.

All diversions and associated structures shall be designed, constructed, maintained and used to ensure stability, prevent, to the extent possible using best technology currently available, additional contribution of suspended solids to streamflow outside the permit area, and comply with all applicable local, state and federal rules.

Permanent diversions of intermittent and perennial streams shall be designed and constructed so as to be erosionally and geomorphically compatible with the natural drainage system.

The design and construction of all diversions for perennial or intermittent streams shall be certified by a qualified registered professional engineer as meeting the diversion standards of the WDEQ *Coal Rules and Regulations* and the approved permit.

When permanent diversions are constructed or stream channels restored after temporary diversions, the operator shall:

- restore, enhance where practicable, or maintain natural riparian vegetation on the banks and flood plain of the stream;
- establish or restore the stream characteristics, including aquatic habitats to approximate premining stream channel characteristics; and

- establish and restore erosionally stable stream channels and flood plains.

The operator shall renovate all permanent diversions in accordance with the approved reclamation plan prior to abandonment of the permit area.

When no longer needed to achieve the purpose for which they were authorized, all temporary diversions shall be removed and the affected land regraded and revegetated, in accordance with this section (5.1). Before diversions are removed, downstream water treatment facilities previously protected by the diversion shall be modified or removed, as necessary, to prevent overtopping or failure of the facilities. This requirement shall not relieve the operator from maintaining water treatment facilities as otherwise required.

Control of Discharge or Drainage. Discharge from sedimentation ponds, permanent and temporary impoundments, coal-processing waste dams and embankments, and diversions shall be controlled, by energy dissipators, riprap channels, and other devices, where necessary, to reduce erosion, to prevent deepening or enlargement of stream channels, and to minimize disturbance of the hydrologic balance. Discharge structures shall be designed according to standard engineering design procedures.

Drainage from acid-forming and toxic-forming material into ground and surface water shall be avoided by:

- identifying, burying, and treating where necessary, material which, in the judgment of the Administrator may adversely affect water quality if not treated or buried;
- preventing water from coming into contact with acid-forming and toxic-forming material and other measures as required by the Administrator; and
- complying with the requirements of Section 5.1.2.3 and such other measures deemed necessary by the Administrator to protect surface water and groundwater.

Surface water shall not be diverted or otherwise discharged into underground mine workings unless specifically authorized by the Administrator per the requirements of Chapter 19, Section 2(a) of WDEQ *Coal Rules and Regulations*.

Groundwater. In addition to meeting the standards of this section (5.1.2), all diversions of groundwater discharge flows shall meet the standards of this section (5.1.2.5).

Diversion Systems - Unchannelized Surface Water and Ephemeral Streams. Surface water shall be diverted around the operation for the following purposes:

- to control water pollution;
- to control unnecessary erosion;
- to protect the on-going operation; and
- to protect the water rights of downstream users.

Temporary diversion of surface runoff or diversions used for erosion control shall meet the following standards:

- in soils or other unconsolidated material, the sides of diversion ditches shall be no steeper than 1½:1;
- in rock, the sides of diversion ditches shall not overhang;
- in soils or unconsolidated materials, the sides and, in ditches carrying intermittent discharges, the bottom shall be seeded with approved grasses so as to take advantage of the next growing season;
- rock riprap, concrete, soil cement or other methods shall be used where necessary to prevent unnecessary erosion;
- culverts or bridges shall be installed where necessary to allow access by the surface owner for fire control and other purposes; and
- diversion ditches shall in a nonerosive manner pass the peak runoff from a 2-year, 6-hour precipitation event, or a storm duration that produces the largest peak flow, as specified by the Administrator.

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In no case shall diversion ditches discharge upon topsoil storage areas, spoil or other unconsolidated material such as newly reclaimed areas.

Permanent diversion structures shall be designed to be erosionally stable during the passage of the peak runoff from a 100-year, 6-hour precipitation event, or a storm duration that produces the largest peak flow, as specified by the Administrator.

Diversion of Intermittent and Perennial Streams. In no case shall spoil, topsoil, or other unconsolidated material be pushed into, or placed below the flood level of a perennial or intermittent stream except during the approved construction of the diversion of said stream.

The WGFD shall be consulted prior to the approval of a diversion of a perennial or intermittent stream.

The banks of a diverted perennial or intermittent stream shall be protected by vegetation by planting approved species to take advantage of the next growing season.

The banks and channel of a diverted perennial or intermittent stream shall be protected where necessary by rock, riprap or similar measures to minimize erosion and degradation of water quality. Permanent diversions shall be designed and constructed to be erosionally stable. The design of the permanent diversion shall also be consistent with the role of the fluvial system.

Mining on the flood plain of a perennial or intermittent stream shall not be permitted if it would cause the uncontrolled diversion of the stream during periods of high water.

Waters flowing through or by the mining operation shall meet the standards set by the EPA and the WDEQ-Water Quality Division in regard to the effect of the operation upon such waters.

If temporary, the channel and flood plain shall be designed to pass, in a nonerosive manner, the 10-year, 6-hour precipitation event, or the capacity of the unmodified stream channel immediately above and below the diversion, whichever capacity is greater, or a duration having a greater peak flow, as specified by the Administrator. Cross-sections of the existing stream above, below and within the disturbed area may be used to determine the flow capacities, channel configuration and shape.

If permanent, the channel and flood plain shall be designed to pass, in a nonerosive manner, the 100-year, 6-hour precipitation event, or a duration having a greater peak flow, as specified by the Administrator. Cross-sections of the existing stream above, below and within the disturbed area may be used to determine the flow capacities, channel configuration and shape.

5.1.2.6 Sedimentation Ponds

Surface Drainage. All surface drainage from affected lands excluding sedimentation ponds, diversion ditches, and road disturbances, shall pass through a sedimentation pond(s) before leaving the permit area. Sedimentation control devices shall be constructed prior to disturbance. The Administrator may grant exemptions to the use of sedimentation ponds where, by the use of alternative sediment control measures, the drainage will meet effluent limitation standards or will not degrade receiving waters.

Mixed Drainage. Where the sedimentation pond(s) results in the mixing of drainage from affected lands with the drainage from undisturbed areas, the permittee shall comply with the applicable effluent limitation standards for all of the mixed drainage where it leaves the permit area.

Construction. Sedimentation ponds shall be designed and constructed to comply with the applicable requirements of Section 5.1.2.7. They shall be located as near as possible to the affected lands and out of intermittent or perennial streams; unless approved by the Administrator.

Maintenance. Sedimentation ponds shall be operated and maintained to comply with the requirements of the WDEQ-Water Quality Division and the Wyoming State Engineer's Office and satisfy the following requirements.

- Chemicals that will harm fish, wildlife, and related environmental values shall not be used for flocculation or other water treatments or if used these ponds will be protected.

- Sedimentation ponds shall be designed and maintained to contain adequate sediment storage as determined by acceptable empirical methods.

- Sluicing of collected sediments shall be prevented for the design precipitation event.

- All areas disturbed by the construction of the sedimentation pond shall be revegetated as soon as practicable to reduce erosion.

Effluent Limitation Standards. The design, construction, and maintenance of a sedimentation pond or other sediment control measures in accordance with this section (5.1.2.5) shall not relieve the operator from compliance with applicable effluent limitation standards of the WDEQ-Water Quality Division.

Removal. Sediment ponds shall be maintained until removal is authorized by the WDEQ-Water Quality Division and the affected lands have been stabilized and initial vegetation established in accordance with the approved reclamation plan and the requirements of this section (5.1). In no case shall sediment ponds treating reclaimed lands be removed sooner than 2 years after the last augmented seeding.

Sediment Control Measures for Affected Lands. Appropriate sediment control measures shall be designed, constructed, and maintained using the best technology currently available to prevent additional contributions of sediment to streamflow or to runoff outside the affected land. Such measures may consist of limiting the extent of disturbed land and stabilizing, diverting, treating or otherwise controlling runoff.

5.1.2.7 Permanent and Temporary Water Impoundments

Permanent Water Impoundments Prohibited. Permanent water impoundments are prohibited unless authorized by the Administrator on the basis that:

- the impoundment and its water quality and quantity will support or constitute a postmining use equal to or greater than the highest previous use of the land;
- discharge of water, if any, from the impoundment shall not degrade the quality of receiving waters; and
- the surface landowner, if different from the mineral owner, has consented to the impoundment.

Permanent Water Impoundments Construction. Permanent water impoundments shall be constructed in accordance with the following requirements.

- Dams must contain an overflow notch and spillway so as to prevent failure by overfilling and washing. Overflow notches and spillways must be riprapped with rock or concrete to prevent erosion.

- The slopes around all water impoundments must be gentle enough so as not to present a safety hazard to humans or livestock and so as to accommodate revegetation. Variations from this procedure may be approved by the Administrator based on the conditions present at the individual locality.

- Mineral seams and other sources of possible water contamination within the impoundment area must be covered with overburden or stabilized in such a manner to prevent contamination of the impounded water.

- Bentonite or other mire-producing material within the impoundment basin shall be removed or covered with materials which will prevent hazards to man or beast.

Major Impoundment. The phrase "major impoundment" shall mean any structure impounding water, sediment or slurry:

- to an elevation of 20 ft or more above the upstream toe to the crest of the emergency spillway; or
- to an elevation of 5 ft above the upstream toe of the structure and has a storage volume of 20 acre-ft or more; or
- which will be retained as part of the postmining land use, and:
  - has an embankment height greater than 20 ft as measured from the downstream toe of the embankment to the top of the embankment; or
  - has an impounding capacity of 20 acre-ft or greater.

Temporary Impoundments. The design, construction and maintenance of permanent and temporary impoundments shall be approved by the Wyoming State Engineer's Office. In addition, the following design and construction requirements shall be applicable.

- The design of impoundments shall be certified by a qualified registered professional engineer as designed to meet the requirements of this part and the applicable requirements of the Wyoming State Engineer, using current, prudent engineering practices. For major impoundments, the certification also shall be filed with the Wyoming State Engineer.

- The vertical portion of any remaining highwall shall be located far enough below the low water line along the full extent of highwall to provide adequate safety and access for the proposed water users.

- Faces of embankments and surrounding areas shall be vegetated, except that faces where water is impounded may be riprapped or otherwise stabilized in accordance with accepted design practices, or where appropriate, WDEQ-Water Quality Division rules and regulations.

- The embankment, foundation, and abutments for all impoundments shall be designed and constructed to be stable. For any major impoundment or any impoundment which may present a danger to life, property or the environment, the Administrator shall require sufficient foundation investigations and laboratory testing to demonstrate foundation stability, and shall require a minimum static safety factor of 1.5 for the normal pool with steady seepage saturation conditions, and a seismic safety factor of at least 1.2.

- All vegetative and organic materials shall be removed and foundations excavated and prepared to resist failure. Cutoff trenches shall be installed if necessary to ensure stability.

- All impoundments shall be inspected regularly during construction and immediately after construction by a qualified registered professional engineer or qualified professional specialist under the direction of a qualified professional engineer. These individuals shall be experienced in impoundment construction. Immediately following each inspection a report shall be prepared and certified by the engineer describing the construction work observed and its conformance with the approved designs. All inspection reports shall be retained at the mine site and submitted in the annual report to the Administrator.

- After completion of construction and until final bond release or removal, all impoundments shall be inspected annually by a qualified registered professional engineer, or by a qualified professional specialist under the direction of the qualified professional engineer. These individuals shall be experienced in impoundment construction. Immediately following each inspection a report shall be prepared and certified by the engineer describing:
    - existing and required monitoring procedures and instrumentation;
    - depth and elevation of any impounded water;
    - existing storage capacity;
    - aspects of the dam that may affect its stability or present any other hazardous condition; and
    - if the impoundment is being maintained in accordance with the approved design and this section (5.1).

    All annual inspection reports shall be retained at the mine site and annually submitted to the Administrator.

- In addition to the post-construction annual inspection requirements contained in the bullet immediately above, all impoundments must be inspected during each of the intervening calendar quarters by a qualified individual designated by the operator. These inspections shall look for appearances of structural weakness and other hazardous conditions.

- Those impoundments subject to 30 CFR 77.216 shall also be inspected in accordance with 30 CFR 77.216-3.

- If any examination or inspection discloses that a potential hazard exists, the operator shall promptly inform the Administrator of the finding and of the emergency procedures formulated for public protection and remedial action. If adequate procedures cannot be formulated or implemented the Administrator shall be notified immediately. The Administrator shall then notify the appropriate agencies that other emergency procedures are required to protect the public.

- Impoundments meeting the criteria of 30 CFR 77.216(a) shall comply with the requirements of 30 CFR 77.216. The plan required to be submitted to the District Manager of MSHA under 30 CFR 77.216 shall also be submitted to the Administrator as part of the permit application.

Spillways. The design precipitation event for the spillways for temporary water impoundments shall be a 25-year, 6-hour precipitation event, or a storm duration having a greater peak flow, as may be required by the Administrator.

Permanent Impoundments. The design precipitation event for the spillways for a permanent impoundment shall be a 100-year, 6-hour precipitation event, or a storm duration having a larger peak flow, as may be required by the Administrator.

Abandonment. Before abandoning an area or seeking bond release, the operator shall ensure that all temporary structures are removed and reclaimed, and that all permanent structures are renovated, if necessary to meet the requirements of this section (5.1.2.7) and to conform to the approved reclamation plan.

Tailings Impoundments. Impoundments to contain mill tailings or slurry tailings shall be constructed in accordance with established engineering principles and shall be approved by the Wyoming State Engineer's Office. A copy of the Wyoming State Engineer's approval shall be attached to the application.

Reclamation of tailings impoundments shall be accomplished by removal and storage of all topsoil present within the tailings basin. After termination of operations, the topsoil shall be replaced and revegetated in accordance with these rules and regulations. If other methods of reclamation and stabilization against wind and water erosion are found to be necessary because of natural conditions, this must be stated and described subject to the Administrator's approval.

5.1.2.8 Protection of Groundwater Recharge Capacity

The recharge capacity of the reclaimed lands shall be restored to a condition which:

- supports the approved postmining land use;
- minimizes disturbances to the prevailing hydrologic balance in the permit area and in adjacent areas; and
- provides a rate of recharge that approximates the premining recharge rate.

5.1.2.9 Water Quality and Quantity

Surface water and groundwater quality and quantity shall be monitored until final bond release to determine the extent of the disturbance to the hydrologic balance. Monitoring shall be adequate to plan for modification of surface mining activities, if necessary, to minimize adverse affects on the water of the State. The operator is responsible for properly installing, operating, maintaining and removing all necessary monitoring equipment. In addition, the operator is responsible for conducting monitoring in accordance with the approved monitoring plan, and submitting all routine monitoring results to the Administrator at least annually. Routine monitoring results shall also be maintained on-site and available to the Director's designated authorized representative, and shall be reasonably current. Noncompliance results for NPDES discharges shall be promptly reported by the operator to the WDEQ-Water Quality Division Administrator. The operator shall promptly report all other noncompliance results to the WDEQ-Land Quality Division Administrator and shall, after consultation with the Administrator, implement appropriate and prompt mitigative measures for those noncompliance situations determined to be mining caused. The monitoring system shall be based on the results of the probable hydrologic consequences assessment and shall include the following.

- A groundwater monitoring program to determine:
  - infiltration rates, subsurface flows, and storage characteristics of the reclaimed land and adjacent areas;
  - the effects of reclamation on the recharge capacity of the reclaimed lands; and
  - suitability of groundwater for current and approved postmining land uses.

- A surface water monitoring program which includes monitoring of surface water flow and quality from affected lands including those that have been graded and stabilized. Results of the monitoring will be used to demonstrate that the quality and quantity of runoff from affected lands with or without treatment will minimize disturbance to the hydrologic balance. Water quality monitoring results for discharges other than those authorized by WDEQ-Water Quality Division shall be reported whenever results indicate noncompliance with effluent limitation standards or degradation of the quality of receiving water shall be reported immediately. Monitoring results shall be available for inspection at the mine site.

5.1.2.10 Roads and Other Transportation Facilities

General Standards for all Transportation Facilities.

Roads and Railroads. Constructed or upgraded roads and railroad spurs shall be included within the permit area from that point that they provide exclusive service and shall be covered by a reclamation bond.

Roads shall not be constructed up a stream channel or so close that the material shall spill into the channel, unless specifically approved by the Administrator.

Streams shall be crossed at or near right angles unless contouring down to the streambed will result in less potential stream bank erosion. Structure of ford entrances and exits must be constructed to prevent water from flowing down the roadway.

Drainage control structures shall be used as necessary to control runoff and to minimize erosion, sedimentation and flooding. Drainage facilities shall be installed as road construction progresses.

Culverts shall be installed at prominent drainageways, or as required by the Administrator. Where necessary, culverts must be protected from erosion by adequate rock, concrete or riprap. Culverts and drainage pipes shall be constructed to avoid plugging, collapsing, or erosion at inlets and outlets.

Trees and vegetation may be cleared only for the essential width necessary to maintain slope stability and to serve traffic needs.

Access, haul roads and drainage structures shall be routinely maintained.

Exemptions concerning roads.

- If approval is obtained from the surface landowner to leave a road unreclaimed, an operator may request in writing that a road be permitted to remain unreclaimed. The operator must furnish proof of the surface landowner's approval. Final decision of road reclamation will be made by the WDEQ-Land Quality Division Administrator.
- In the event that the surface landowner, a city or town, another agency of the State of Wyoming or an agency of the United States government has requested that a road not be reclaimed, no bond shall be required of the applicant for the reclamation of the road and reclamation of the road shall not be required; provided, however, that the Administrator receives a copy of the written request from the surface owner, city or town, or agency of the state or federal government, for retention of the road.

General Performance Standards for Haul Roads, Access Roads, or Light-use Roads. Roads shall be located on ridges or on the most stable available slopes to minimize erosion, sedimentation and flooding. All exposed surfaces shall be stabilized in accordance with current, prudent engineering practices.

Acid or toxic-forming substances shall not be used in road surfacing.

To the extent possible using the best technology currently available, roads shall not cause damage to fish, wildlife, and related environmental values and shall not cause additional contributions of suspended solids to streamflow or to runoff outside the affected land or permit area. Any such contribution shall not be in excess of limitations of state or federal law or degrade the quality of receiving water.

The normal flow of water in streambeds and drainage channels shall not be significantly altered. Damage to public or private property shall be prevented or controlled.

All embankments shall have, at a minimum, a static safety factor of 1.3.

The design and construction or reconstruction shall incorporate appropriate limits for grade, width, surface materials, surface drainage control, culvert placement, culvert size, and such other design criteria required by the Administrator to ensure environmental protection and safety appropriate for the planned duration and use.

All roads shall be maintained and/or repaired, if damaged, to meet the performance standards of this section (5.1.2.10).

All roads shall be closed to vehicular travel when no longer needed and reclaimed in accordance with this section (5.1) unless the road is retained for use under an approved postmining land use.

Performance Standards for Haul Roads and Access Roads. Design and construction: The design and construction or reconstruction of haul roads and access roads shall be certified by a registered professional engineer as meeting the requirements of this section (5.1.2.10); current, prudent engineering practices; and any design criteria required by the Administrator.

Stream fords are prohibited unless they are specifically approved by the Administrator as temporary routes during periods of construction.

Drainage.

- Haul and access roads shall be designed, constructed, or reconstructed and maintained with drainage control structures capable of safely passing the runoff from a 10-year, 6-hour precipitation event, or a storm duration having a greater peak flow, unless otherwise specifically approved by the Administrator. The drainage control system shall include, but not be limited to bridges, culverts, ditches, cross drains, and ditch-relief drains.
- All drainage pipes or culverts shall be constructed and maintained to avoid plugging, collapse and erosion at inlets and outlets.
- All culverts shall be designed, constructed, and maintained to sustain the vertical soil pressure, passive resistance of the foundation, and the weight of vehicles to be used.
- Ephemeral (shown on a USGS 7.5 minute series quad), intermittent or perennial streams shall not be altered or relocated for road construction or reconstruction without approval from the Administrator, and then, only if the natural channel drainage is not blocked except during periods of low flow or when flow has been acceptably diverted around the site, there is no significant damage to hydrologic balance, and there is no adverse impact on adjoining landowners.
- Drainage ditches shall be designed to prevent uncontrolled drainage over the road surface and embankment. Trash racks and debris basins shall be installed in the drainage ditches where debris from the drainage area may impair the functions of drainage and sediment control structures.
- Except as provided in the paragraph concerning stream fords, above, drainage structures which are used for stream channel crossings shall be made using bridges, culverts, or other structures designed, constructed, and maintained using current, prudent engineering practices.

Surfacing. Roads shall be surfaced with rock, crushed gravel, asphalt, or other material sufficiently durable for the anticipated volume of traffic and weight and speed of vehicles to be used.

Maintenance. Routine maintenance shall include repairs to the road surface, blading, filling potholes and adding replacement gravel or asphalt. It shall also include revegetation, brush removal, and minor reconstruction of road segments as necessary.

Railroad and Other Transportation and Mine Facilities. Railroad loops, spurs, sidings, surface conveyor systems, chutes, aerial tramways, or other transportation and mine facilities shall be designed, constructed, or reconstructed, and maintained and the area restored to:

- prevent, to the extent possible using the best technology currently available, damage to fish, wildlife, and related environmental values, and additional contributions of suspended solids to streamflow or runoff outside the affected land and permit area. Any such contributions shall not be in excess of limitations of state or federal law or degrade the quality of receiving water;
- control and minimize diminution or degradation of water quality and quantity;
- control and minimize erosion and siltation;
- control and minimize air pollution; and
- prevent damage to public or private property.

Railroads and other transportation and mine facility areas shall be reclaimed when no longer needed for the operation in accordance with the requirements of this section (5.1)

5.1.2.11 Time Schedule

Reclamation must begin as soon as possible after mining commences and must continue concurrently until such time that the mining operation is terminated and all of the affected land is reclaimed. If conditions are such that final reclamation procedures cannot begin until the mining operation is completed, this must be explained in the reclamation plan. A detailed time schedule for the mining and reclamation progression must be included in the reclamation plan. This time schedule shall:

- apply to reclamation of all lands to be affected in the permit area;
- designate times for backfilling, grading, contouring and reseeding;
- be coordinated with a map indicating the areas of progressive mining and reclamation;
- establish reclamation concurrently with mining operations, whenever possible. If not possible, the schedule shall provide for the earliest possible reclamation consistent with the orderly and economic development of the property; and
- if the Administrator approves a schedule where reclamation follows the completion of mining, describe the conditions which will constitute completion or termination of mineral production.

5.1.2.12 Unanticipated Conditions

An operator encountering unanticipated conditions shall notify the Administrator as soon as possible and in no event more than five days after making the discovery.

An unanticipated condition is any condition encountered in a mining operation and not mentioned by the operator in his mining or reclamation plan which may seriously affect the procedures, timing, or outcome of mining or reclamation. Such unanticipated conditions include but are not limited to the following.

- The uncovering during mining operations of any acid-forming, radioactive, inflammable, or toxic materials which must be burned, impounded, or otherwise disposed of in order to eliminate pollution or safety hazards.
- The discovery during mining operations of a significant flow of groundwater in any stratigraphic horizon.
- The occurrence of slides, faults, or unstable soil and overburden materials

which may cause sliding or caving in a pit which could cause problems or delays with mining or reclamation.

- The occurrence of uncontrolled underground caving or subsidence which reaches the surface, causing problems with reclamation and safety hazards.
- A discovery of significant archeological or paleontological importance.

In the case of the uncovering of hazardous materials, the operator shall take immediate steps to notify the Administrator and comply with any required measures to eliminate the pollution or safety hazard. Under all conditions the operator must take appropriate measures to correct, eliminate, or adapt to an unanticipated condition before mining resumes in the immediate vicinity of that condition.

5.1.2.13 Disposal of Buildings and Structures

All buildings and structures constructed, used or improved by the operator must be removed or dismantled unless it can be demonstrated to the Administrator's satisfaction that the buildings or structures will be of beneficial use in accomplishing the proposed use of the land after reclamation or for environmental monitoring.

If the operator does not wish to remove certain buildings or facilities, he must obtain the written consent of the surface landowner to leave the buildings or facilities intact. The operator must make a request in writing, providing written proof of the above to the WDEQ-Land Quality Division that the buildings or facilities be permitted to remain intact.

5.1.2.14 Support Building Construction

All support buildings, including loading and storage facilities, plants, sheds, shops and other buildings shall be designed, constructed or reconstructed and located to prevent or control erosion, pollution, and damage to public or private property, fish, wildlife, and related environmental values. All operations shall be conducted so as to minimize disruption of any services provided by facilities located on, under or through the permit area, unless otherwise approved by the Administrator or owner of such facilities.

5.1.2.15 Signs and Markers

Uniform and durable signs and markers of an adequate size shall be posted by the operator at those points applicable to the areas or activities to which they pertain. Such signs and markers shall include mine and permit identification signs, perimeter markers, buffer zone markers, blasting signs and soil markers. The operator shall place and maintain all signs and markers prior to commencement and until the completion of the activities to which they pertain, which, for mine and permit identification signs, shall be at the time the bond is released.

5.1.2.16 Drilled Holes and Other Exposed Underground Openings

Plugging, sealing and capping of all drilled holes except those used solely for blasting or developmental drill holes which will be mined through within 1 year shall meet the requirements of Chapter 14 of the WDEQ *Coal Rules and Regulations*. Developmental drilling shall meet the plugging and sealing requirements of WS 35-11-404, where necessary. Temporary sealing and use of protective devices may be approved by the Administrator if the hole will be used for returning coal-processing waste or water to underground workings or monitoring groundwater conditions, and shall be used, at a minimum, for developmental drilling. Other exposed underground openings shall be properly managed as required by the Administrator to prevent access to mine workings and to keep acid or other toxic drainage from entering ground or surface water.

With the prior approval of the Administrator and the Wyoming State Engineer, wells may be transferred to another party for further use. The permittee shall remain responsible for the proper management of the well until final bond release.

5.1.2.17 Air Resources Protection

All exposed surface areas shall be protected and stabilized to effectively control erosion and air pollution attendant to erosion.

5.1.2.18 Fish and Wildlife Performance Standards

Disturbance. An operator shall, to the extent possible using the best technology currently available and consistent with the approved postmining land use, minimize disturbance and adverse impacts on fish, wildlife, and related environmental values, and achieve enhancement of such resources where practicable, which activities shall include the following.

- Properly construct, locate and operate roads and powerlines, including proper design of powerlines to avoid electrocution of raptors.

- Prevent access to areas such as roadways or ponds with hazardous materials, to avoid damage to wildlife without limiting access to known important routes.

- Afford protection, restore and enhance where practicable important habitats to fish and wildlife. This shall include, but is not limited to, wetlands and riparian vegetation along rivers and streams and bordering ponds and lakes.

- Select plant species with shrubs well represented, which will enhance the nutritional and cover aspects of fish and wildlife habitat, where such habitat is identified as part of the postmining use, and distribute the reestablished habitat in a manner which includes a diversity and interspersion of habitats, optimizes edge effect, cover and other benefits for fish and wildlife, and is consistent with Section 5.1.2.4.

- Promptly report to the regulatory authority any species or critical habitat of such species listed as threatened or endangered, or any golden or bald eagle nest in or adjacent to the permit area, which was not reported or investigated in the permit application. Upon notification the Administrator shall consult with the WGFD and the USFWS and, after consultation, shall identify whether and under what conditions the operator may proceed.

- Where the postmining land use is for cropland, to the extent not inconsistent with this intended use, operators shall restore habitat types to break up large blocks of monocultures.

Stream buffer zone. No land within 100 ft of a perennial or intermittent stream shall be affected unless the Administrator specifically authorizes such activities closer to or through such a stream upon a finding that:

- surface mining activities will not cause or contribute to the violation of applicable state or federal water quality standards, and will not adversely affect the water quantity and quality or other environmental resources of the stream; and
- if there will be a temporary or permanent stream-channel diversion, it will comply with all stream diversion requirements.

The area not to be affected shall be designated a buffer zone, marked in the field and on the mine plan map.

Surface Mining Activity. No surface mining activity shall be conducted which is likely to jeopardize the continued existence of endangered or threatened species listed by the State or the

Secretary of the Interior or which will result in the destruction or adverse modification of designated critical habitats of such species in violation of the Endangered Species Act (16 USC 1531 et seq.). No surface mining activity shall be conducted in a manner which would result in the unlawful taking of a bald or golden eagle, its nest, or any of its eggs. The Administrator shall consult with the state and federal fish and wildlife agencies to identify whether and under what conditions the operation may continue under this provision.

Surveys. The operator shall perform periodic surveys, in the level of detail and for those areas as determined by the Administrator, in accordance with Appendix B of the WDEQ *Coal Rules and Regulations*.

5.1.2.19 Slides and Other Damage

Where instability may exist in backfill materials, an undisturbed natural barrier shall be provided to prevent slides and erosion, beginning at the elevation of the lowest coal seam to be mined and extending from the outslope for such distance as may be determined by the Administrator.

5.1.2.20 Surface Activities

Only those operations designed to protect disturbed surface areas and which result in improved resource recovery, abatement of water pollution, or elimination of hazards to the public shall be conducted within 500 ft of an active or abandoned underground mine. Approval for such operation shall be obtained from MSHA for operations proposed to be conducted within 500 ft of an active underground mine. The Administrator shall specifically approve operations proposed to be conducted within 500 ft of an abandoned underground mine.

5.1.2.21 Cessation of Operations

When it is known that a temporary cessation of operations will extend beyond 30 days, the operator shall submit to the Administrator that information required in an annual report.

5.1.2.22 Fuel Conservation

The operator shall conduct operations so as to maximize the utilization and conservation of the solid fuel resource being recovered so that reaffecting the land in the future can be minimized.

5.1.2.23 Hydrologic Disturbance

The operator shall conduct all operations in such a manner as to minimize disturbance of the hydrologic balance within the permit and adjacent areas, to prevent material damage to the hydrologic balance outside the permit area, to assure the protection or replacement of water rights, and to support approved postmining land uses in accordance with the terms and conditions of the approved permit and the performance standards discussed above. Mining and reclamation practices that minimize water pollution and changes in flow shall be used in preference to water treatment.

5.2 WDEQ ENVIRONMENTAL PROTECTION PERFORMANCE STANDARDS FOR UNDERGROUND MINING OPERATIONS

5.2.1 General Performance Standards

5.2.1.1 Land Uses

Surface Lands. All surface land affected in conjunction with an underground mining operation will be subject to the appropriate backfilling, grading, and contouring requirements described in Section 5.1.2.2, depending on the physical land description in the permit area and the nature of the surface disturbance.

Shafts and Adits. All shafts and adits to underground mine workings must be properly sealed at closure.

Portal Entries. Portal entries into adits must be backfilled, graded, and contoured so as to blend in with the topography of the surrounding terrain.

Subsidence. All substantial surface disturbances due to subsidence into underground workings within 5 years after completion of mining shall be backfilled, graded, contoured, and revegetated so as to blend in with the topography of the surrounding terrain. If conditions prevent such reclamation, the *Administrator*, after considering the conditions, and after consultation with the Advisory Board, will determine the reclamation requirements.

5.2.1.2 Performance Standards

The performance standards contained in the Wyoming *Environmental Quality Act*, as amended, and Section 5.1, above, shall apply to underground mining operations.

5.2.2 Performance Standards Specific to Underground Coal Mining Operations

5.2.2.1 Waste

Underground development waste and excess spoil shall be disposed of as discussed in Section 5.1.2.3.

5.2.2.2 Access

Surface entries and accesses to underground workings, including adits and slopes, shall be located, designed, constructed, and utilized to prevent or control gravity discharge of water from the mine in excess of state or federal water quality standards.

5.2.2.3 Subsidence

Underground mining activities shall be planned and conducted so as to prevent subsidence from causing material damage to structures, the land surface, and groundwater resources.

5.2.2.4 Restrictions on Location of Underground Mining

Underground mining shall not be conducted beneath or adjacent to any park, cemetery, public building, facility (i.e., churches, schools, hospitals, etc.), or body of water with a volume of 20 acre-ft or more, unless the *Administrator* approves otherwise on the basis of detailed subsurface information demonstrating that subsidence will not cause material damage or reduce the reasonably foreseeable use of the feature or facility.

5.2.2.5 Aquifers

Underground mining activities beneath any aquifer that serves as a source of water for public drinking, domestic, industrial, or agricultural use should be conducted so as to avoid disruption of the aquifer and consequent exchange of groundwater between the aquifer and other strata. The *Administrator* may prohibit mining in the vicinity of the aquifer, or may limit extraction to protect the aquifer and water supply.

5.2.2.6 Populated Areas

The *Administrator* shall suspend underground mining under urbanized areas, cities, towns, and communities, and adjacent to industrial or commercial buildings, major impoundments, or permanent streams, if imminent danger is found to exist for inhabitants of the urbanized areas, cities, towns, or communities, or material damage is threatened to the urbanized areas, cities, towns, or communities.

5.2.2.7 Applicability of Other Regulations

All applicable regulations contained in the Wyoming *Environmental Quality Act* and Section 5.1.2, above, shall apply to underground coal mining operations. The approximate original contour requirements of Section 5.1.2.2 may be waived in situations where settled surface disturbances have become stabilized and revegetated.

5.2.2.8 Performance Standards

The performance standards contained in the *Wyoming Environmental Quality Act* and Chapter 5: Performance Standards for Special Categories of Surface Coal Mining, of the WDEQ *Coal Rules and Regulations* (excluding Section 1) shall apply to underground mining operations for areas that will be actively used over extended periods and which affect a minimal amount of land.

5.2.3 Submission of Mining Plan

The operator of an underground coal mining operation shall submit a plan of underground workings pursuant to a schedule approved by the Administrator. The plan shall include maps and descriptions of significant features of the underground mine, extraction ratios, measures taken to prevent or minimize subsidence and related damage, areas of full extraction, and other information, as required by the Administrator.

5.3 BLM REQUIREMENTS AND MITIGATION

5.3.1 Coal Requirements and Mitigation

5.3.1.1 Introduction

Lessees will be required to develop their federal leases in compliance with applicable federal, state, and local laws and regulations. These would be considered in-place constraints on a lessee's activities.

All areas identified in this document as acceptable for further consideration for coal leasing are subject to the following mitigation requirements.

5.3.1.2 Cultural Resources

Before undertaking any activities that may disturb the surface of the leased lands, the lessee shall conduct a cultural resource intensive field inventory in a manner specified by the Authorized Officer (AO) of BLM on portions of the mine plan area and adjacent areas, or exploration plan area, that may be adversely affected by lease-related activities and which were not previously inventoried at such a level of intensity. The inventory shall be conducted by a qualified professional cultural resource specialist (i.e., archaeologist, historian, or historical architect, as appropriate) approved by the AO of the surface managing agency (BLM if the surface is privately owned), and a report of the inventory and recommendations for protecting any cultural resources identified shall be submitted to the Regional Director of the OSM and the AO of BLM (or only to the AO of BLM if activities are associated with coal exploration outside an approved mining permit area), to protect cultural resources on the leased land. The lessee shall undertake measures, in accordance with instructions from the Regional Director or AO to protect cultural resources on the leased land. The lessee shall not commence the surface-disturbing activities until permission to proceed is given by the Regional Director or AO.

The lessee shall protect all known cultural resource properties within the lease area from lease-related activities until the cultural resource mitigation measures can be implemented as part of an approved mining and reclamation plan or exploration plan.

The cost of conducting the inventory, preparing reports, and carrying out mitigation measures shall be borne by the lessee.

If cultural resources are discovered during operations under a lease, the lessee shall immediately bring them to the attention of the Regional Director or AO, or the AO of the surface managing agency if the Regional Director is not available. The lessee shall not disturb such resources except as may be subsequently authorized by the Regional Director or AO. Within two (2) working days of notification, the Regional Director or AO will evaluate or have evaluated any cultural resources discovered and will determine if any action may be required to protect or preserve such discoveries. The cost of data recovery for cultural resources discovered during lease operations shall be borne by the surface managing agency unless otherwise specified by the AO of BLM or of the surface managing agency (if different).

All cultural resources shall remain under the jurisdiction of the U.S. until ownership is determined under applicable law.

5.3.1.3 Paleontological Resources

If paleontological resources, either large and conspicuous and/or of significant value, are discovered during construction, the find will be reported to the AO immediately. Construction will be suspended within 250 ft of said find. An evaluation of the paleontological discovery will be made by a BLM-approved professional paleontologist within five (5) working days, weather permitting, to determine the appropriate actions(s) to prevent the potential loss of any significant paleontological value. Operations within 250 ft of such discovery will not be resumed until written authorization to proceed is issued by the AO. The lessee will bear the cost of any required paleontological appraisals, surface collection of fossils, or salvage of any large conspicuous fossils of significant scientific interest discovered during the operations.

5.3.1.4 Black-footed Ferret Habitat

The lessee will be required to monitor and inventory the lease area for establishment of potential black-footed ferret habitat (i.e., prairie dog towns) and, if any such habitat is found, to conduct ferret inventories, all in accordance with the guidelines below. In the event that ferret occurrence is identified, the lessee shall notify the BLM and USFWS and will be required to adhere to any modifications in the mining operation provided by the USFWS and the BLM to protect the endangered species.

The following Black-footed Ferret Inventory Guidelines will be followed. Proposed developments such as coal lease lands, power plant sites, well fields, dam sites, and facilities relating to these developments should be surveyed for prairie dogs before the project is approved. If prairie dogs are found on the proposed site, colonies should be mapped on topographic maps and each colony surveyed using recommended USFWS Black-footed Ferret Survey Procedures. Ferret searches should be scheduled as close to actual construction as possible and not more than 1 year prior to disturbance to minimize the possibility of missing ferrets that might move on the area during the period between completion of surveys and the start of construction. Where project disturbance takes place over a long period of time, such as on a coal site, additional surveys or baseline studies for black-footed ferrets are recommended. Results of these surveys will be submitted to the BLM and USFWS for review and clearance. In addition, any burrowing owl nests will be noted and reported to BLM and USFWS.

5.3.2 Carbon Basin Conditional Requirements and Mitigation

As a result of the coal screening process the following conditional requirements and/or mitigation measures would be applied to surface-disturbing activities associated with mining and development of the federal coal in the Carbon Basin area.

5.3.2.1 Cultural Resources Management

In order to preserve the historic setting surrounding the Town of Carbon Cemetery, 120 acres of federal coal lands would be open to consideration for further leasing and development for subsurface mining methods only. Surface occupancy and surface disturbance on this area would be prohibited.

5.3.2.2 Paleontological Resources Management

If paleontological resources, either large and conspicuous and/or of significant value are discovered during construction, the find will be reported to the AO immediately. Construction will be suspended within 250 ft of said find. An evaluation of the paleontological discovery will be made by a BLM-approved paleontologist within five (5) working days, weather permitting, to determine the appropriate action(s) to prevent the potential loss of any significant paleontological value. Operations within 250 ft of such discovery will not be resumed until written authorization to proceed is issued by the AO. The lessee will bear the cost of any required paleontological appraisals, surface collection of fossils, or salvage of any large conspicuous fossils of significant scientific interest discovered during the operations.

5.3.2.3 Lands and Realty Management Program

Existing roads and/or ROWs for powerlines and pipelines would be relocated to accommodate coal mining and related activities. Areas with existing ROWs would be open to coal leasing and development, subject to valid existing rights and negotiations for relocating pipelines and powerlines, if necessary. Prior rights would be protected for all ROWs of record. Any unforeseen conflicts in the planning review area would be identified and resolved during the coal leasing process or during development of mining and reclamation plans.

Surface or subsurface coal mining and surface-related activities would be prohibited on federal coal lands within a 100-ft buffer zone around cemeteries and a 300-ft buffer around occupied structures. Should conflicts arise, it would be the responsibility of the lessee to show that the conflicts between mining activity and the buffer zone would be adequately addressed and mitigated to the satisfaction of both parties. These situations, if they arise, would be addressed during the course of processing federal coal lease applications and prior to issuing any federal coal lease.

Because mining in the planning review/windpower project overlap area may not occur in the near future, and because placement of wind energy facilities or coal mining activities cannot be determined at this time, BLM has placed the following provision in the wind energy ROW grant:

> Federal coal resources underlie a portion of the Simpson Ridge Windpower Project Area. To prevent federal coal resources from being devalued by surface improvements, the grant holder may place wind energy facilities on the public lands identified below, but bears the responsibility for repair, replacement, or lost revenue should the BLM subsequently lease federal coal and the mining of such coal damage or impair the operation of wind energy facilities. The lands subject to this condition are:
>
> T. 21 N., R. 80 W.
> Section 12: All
> Section 14: All
>
> T. 22 N., R. 80 W.
> Section 22: NE¼, S½
> Section 26: N½NW¼, SW¼NW¼
> Section 34: All

5.3.2.4 Oil and Gas Management

Conflicts could arise where 8,634.64 acres of federal oil and gas leases overlap federal coal areas open to consideration of coal development and leasing. To allow for full development of both resources, current BLM policy (see Coal Appendix), including use of appropriate lease stipulations, would be used to resolve any conflicts that arise between oil and gas development and coal development.

5.3.2.5 Soil, Water, and Air Management

Riparian habitat and wetland areas would be open to consideration of coal development and leasing. During the mine permitting process, it may be determined that some drainages would be best avoided, while short reaches of other drainages would be diverted around mine pits and held in temporary channels and/or ponds.

In potential alluvial valley floors and adjacent areas, where coal mining could interrupt or intercept water flow to farming areas along drainages, mining of federal coal would be allowed only with appropriate mitigation measures made part of an approved mine plan or permit.

5.3.2.6 Wildlife Habitat and Fisheries Management

All federal coal lands that are open to consideration for leasing and development would be subject to continued field investigations, studies, and evaluations to determine if certain methods of coal mining can occur without having a long-term impact on wildlife, in general, and on threatened and endangered species and their essential habitats.

Required surveys for prairie dog complexes would be included in the stipulations for any federal coal lease that may be issued in the area. Any area found to support an endangered species would be acceptable for coal development with a provision that any federal coal lease issued would include a requirement for developing appropriate mitigation measures that would protect the long-term interests of the species and habitats involved. The USFWS has recommended that if black-tailed prairie dog colonies or complexes greater than 79 acres or white-tailed prairie dog colonies or complexes greater than 200 acres would be disturbed, surveys for black-footed ferrets should be conducted.

Prior to leasing federal coal, surveys would be completed for bald and golden eagle roosts and nests, falcon cliff nesting sites, and birds protected under the Migratory Bird Treaty Act.

A Biological Assessment (BA) would be prepared in conjunction with the EIS or EA that is prepared prior to issuing federal coal leases. As a result of the BA, EIS or EA, other stipulations may be identified, to the effect that the lessee would be required to develop mitigation measures or habitat improvement, development, or reclamation plans to the satisfaction of the BLM and USFWS. Mitigation measures may include, but would not be limited to, such things as seasonal operations in some areas, buffer zones around occupied nests (e.g., eagles, falcons), protection of active (not necessarily occupied) nests at all times (unless otherwise provided by USFWS), on-site or off-site (but on-lease) habitat improvement or development, special reclamation measures, or other appropriate measures for long-term habitat protection.

Mitigative measures would be combined with appropriate mining methods to reduce impacts of mining in antelope and deer crucial winter ranges within the planning review area in order to maintain a long-range balance between habitat needs and coal development.

Grouse habitat areas would be open to coal development with stipulations and mitigation requirements for habitat maintenance, improvement, development and reclamation. Exploration activities and ancillary facilities would be allowed provided that (1) the surface-disturbing activities related to exploration and ancillary facility development avoid the lek and 0.25 mi distance from the lek area, if possible, and where not possible, intensive mitigation were applied; (2) permanent and high profile structures, such as buildings, overhead powerlines, other types of high profile ancillary facilities, etc., were prohibited in the lek and a 0.25 mi distance from the lek area; (3) during the grouse mating season, surface uses and activities were prohibited between the hours of 6:00 p.m. and 9:00 a.m., within 0.5 mi of the leks; (4) if surface disturbance in the nesting area within a 2 mi distance of a lek were limited to only actual mining activity and other activities were subject to seasonal limitations; and (5) if it were attempted to relocate lek and nesting complexes that are disturbed or destroyed by coal mining (relocation efforts are to be coordinated with the BLM, WGFD and other appropriate state agencies).

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6.0 CONSULTATION AND PREPARERS

Personnel contacted or consulted during preparation of this EIS are listed in Table 6.1. The list of preparers and participants is given in Table 6.2.

Table 6.1 Personnel Contacted or Consulted.

Agency or Organization	Individual	Position
Arch	Paul Lang	President
	Ed Turner	Project Manager
	Steve Skorcke	Manager of Technical Services
Carbon County Assessor	Darryl Stubbs	Assessor
Cyprus Shoshone Coal Company	Rita Clark	Engineer
Individuals	Jim Nyenhuis	Consulting Soil Scientist
Intermountain Resources, Inc.	Jim Orpet	Biologist
Mine Engineers, Inc.	Eldon Strid	Mine Engineer
Rosebud Coal Company	Joe Dallmann	Engineer
University of Wyoming		
Department of Geology and Geophysics	Jason Lillegraven	Paleontologist
	Ross Secord	Paleontologist
U.S. Army Corps of Engineers	Chandler Peter	Project Manager
	Tom Johnson	Project Manager
U.S. Fish and Wildlife Service	Dave Felley	Biological Technician
	Kim Dickerson	Biologist
Western EcoSystems Technology Inc.	Dave Young, Jr.	Wildlife Biologist
Western Water Consultants, Inc.	Daryl Jensen	Engineer
	Carla Rumsey	Hydrologist
	Todd Heslin	Civil Engineer/Hydrologist
Wyoming Department of Environmental Quality	Barry Shelly	Project Manager, Abandoned Mine Lands
Wyoming Department of Transportation	Jay Gould	District Engineer
	Andrew Long	District Engineer
	Shawn Miller	District Traffic Technician
	William Whipple	Senior Engineering Technician
Wyoming Economic Analysis Division	Wayne Liu	Statistician
Wyoming Employment Security	Dave Bullard	Statistician, Unemployment
	Nancy Brennan	Statistician, Covered Employment

Table 6.1 (Continued)

Agency or Organization	Individual	Position
Wyoming Game and Fish Department	Pat Deibert Richard Guenzel Bob Luce	Habitat Protection Biologist Wildlife Biologist Nongame Mammal Biologist
Wyoming Geological Survey	James Case	Geologist
Wyoming State Engineers Office	John Barnes	Engineer
Wyoming Water Resource Center	Amy Bedell Barry Lawrence	Data Specialist Water Resource Data System Coordinator

Table 6.2 List of Preparers and Participants.

Name	Education/Experience	EIS Responsibility
BLM INTERDISCIPLINARY TEAM AND ADDITIONAL REVIEWERS		
Susan Caplan	M.S. Air Resource Management (pending), B.S. Meteorology; 14 years professional experience	Air Quality
Jeff Carroll	M.S. Plant Ecology, B.S. Wildlife, Botany, Range Management, Forestry; 23 years professional experience	Reviewer
Krystal Clair	B.A. Recreation Administration; 7 years professional experience	Recreation and Visual Resources
Sarah Crocker	B.S. Range Management; 5 years professional experience	Vegetation and Agriculture
Gary DeMarcay	M.S. Anthropology, B.S. Anthropology; 24 years professional experience	Cultural Resources
Susan Foley	B.S. Range Management; 10 years professional experience	Soils and Watershed
Walt George	M.S. Ecology, B.S. Wildlife Management; 21 years professional experience	Reviewer
Ken Henke	B.S. Wildlife Biology; 18 years professional experience	Noise, Hazardous Materials
Bob Janssen	M.S. Geology, B.S. Earth Science; 23 years professional experience	Reviewer
Jon Johnson	B.A. Geography; 32 years professional experience	Wyoming State Office Project Leader
Dave McWhirter	B.S. Range Watershed Management; 14 years professional experience	Surface and Groundwater Impacts
Brenda Neuman	B.S. Geological Engineering, 9 years professional experience	ID Team Leader
Mark Newman	B.S. Geology; 19 years professional experience	Fluid and Solid Mineral Occurrence, Paleontology
Dave Roberts	M.S. Fish and Wildlife Management, B.S. Fish and Wildlife Management; 30 years professional experience	Reviewer
Marilyn Roth	18 years professional experience	Land Use
Mel Schlegel	M.S. Agricultural Economics, B.S. Agricultural Economics; 29 years professional experience	Wyoming State Office Coal Coordinator

Table 6.2 (Continued)

Name	Education/Experience	EIS Responsibility
John Spehar	B.S. Forest and Range Management; 20 years professional experience	Environmental Coordinator
Karla Swanson	B.S. Range and Wildlands; Public Administration; 20 years professional experience	Area Manager
Ann Watson	B.S. Fisheries Science; 3 years professional experience	Wetland/Riparian Area Review, Wildlife
OFFICE OF SURFACE MINING		
Floyd McMullen	M.S. Environmental Science, B.S. Range/Forest Management; 25 years professional experience	OSM Project Coordinator
TRC MARIAH ASSOCIATES INC.		
S.L. Tiger Adolf	J.D. Law, B.S. Agricultural Business, A.A.S. Farm Business Management and Analysis; 12 years professional experience	Document Production/Coordination
Karyn C. Chani	M.S. Botany, M.S. Geology, B.A. Geology; 14 years professional experience	Project Management, Project Description, Physical Resources, Visual Resources
William Batterman	B.A. Archaeology; 19 years professional experience	Cultural Resources
Gamiel G. DeCastro	B.S. Business Administration; 18 years professional experience	Technical Editing, Document Production
Jan K. Hart	M.S. Rangeland Ecology and Watershed Management, B.S. Fisheries Management, A.A.S. Natural Resources Conservation; 5 years professional experience	Water Resources, Soils, Vegetation
Susan Haines	B.S. Industrial Technology (pending); 18 years professional experience	Air Quality
Carolyn W. Hayden	B.S. Animal Science; 15 years professional experience	Document Production/Coordination
Kelly M. Heinrich	9 years professional experience	Document Production/Coordination
Craig L. Kling	M.S. Wildlife Biology, B.A. Ecology and Wildlife; 22 years professional experience	Wildlife, TE&C Species, Quality Assurance
Tamara Linse	6 years professional experience	Technical Editing/Document Production/Coordination
Suzanne Lahr	B.S. Geology; 16 years professional experience	AutoCAD Drafting

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Table 6.2 (Continued)

Name	Education/Experience	EIS Responsibility
Roger A. Schoumacher	M.S. Fisheries, B.S. Wildlife Management; 33 years professional experience	Quality Assurance
Craig S. Smith	M.A. Anthropology, B.A. Anthropology; 20 years professional experience	Cultural Resources
Diane Thomas	M.S. Zoology and Physiology, B.S. Wildlife Management, 8 years professional experience	Wildlife, TE&C Species
ERATHEM-VANIR GEOLOGICAL CONSULTANTS		
Gus Winterfeld	Ph.D., M.S. Geology; B.S. Zoology; 22 years professional experience	Paleontology

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7.0 REFERENCES, ACRONYMS, ABBREVIATIONS, AND GLOSSARY

7.1 REFERENCES

Air Sciences. 1990. Technical report air emission permit modification application, Medicine Bow Mine, Hanna, Wyoming. Prepared for Arch of Wyoming by Air Sciences Inc., Project 15-05, Lakewood, Colorado.

Allen, J.N. 1980. The ecology and behavior of the long-billed curlew in southeastern Washington. Wildlife Monographs 73:1-67.

American Fisheries Society. 1991. Common and scientific names of fishes from the United States and Canada. Fifth edition. American Fisheries Society Special Publication 20. American Fisheries Society, Bethesda, Maryland. 183 pp.

Arch of Wyoming. 1998. Employee Handbook.

Avian Power Line Interaction Committee. 1994. Mitigating Collisions with Power Lines: The State of the Art in 1994. Edison Electric Institute. Washington, D.C. 78 pp. + append.

Baxter, G.T., and J.R. Simon. 1970. Wyoming fishes. Wyoming Game and Fish Department Bulletin No. 4. Wyoming Game and Fish Department, Cheyenne, Wyoming. 168 pp.

Baxter, G.T., and M.D. Stone. 1985. Amphibians and Reptiles of Wyoming. Second edition. Wyoming Game and Fish Department, Cheyenne, Wyoming. 137 pp.

Behle, W.H., and M.L. Perry. 1975. Utah birds. Utah Museum of Natural History, Salt Lake City, Utah.

Bonneville Power Administration. n.d. Unpublished data.

Borden, G.W., R.R. Fletcher, and D.A. Taylor. 1994. Economic Impact of Coal on Wyoming's Economy. Cooperative Extension Service, Department of Agricultural Economics, College of Agriculture, University of Wyoming, Laramie. 37 pp.

Bowen, C.F. 1918. Stratigraphy of the Hanna Basin, Wyoming. U.S. Geological Survey Professional Paper 108-L. p. 227-241.

Braun, C.E., T. Britt, and R.O. Wallestad. 1977. Guidelines for maintenance of sage grouse habitats. Wildlife Society Bulletin 5(3):99-106.

Breithaupt, B.H. 1985. Non-mammalian vertebrate faunas from the Late Cretaceous of Wyoming *In* G.E. Nelson (ed.), Cretaceous of Wyoming. Wyoming Geological Association 36th Annual Field Conference Guidebook. p. 159-175.

_____. 1994. News for University of Wyoming, Department of Geology and Geophysics. Society of Vertebrate Paleontology, News Bulletin, February 1994. p. 89-90.

Bryan, F.T. 1857. *Road from Fort Riley to Bridger's Pass.* 35th Cong., 2d Sess., House Executive Doc. No. 2., (Serial 943), Cornelius Wendell, Washington, D.C.

Bullard, D. 1997. Statistician, Wyoming Department of Employment, Casper. Personal communication on September 2, 1997. Contacted by Roger Schoumacher, TRC Mariah Associates Inc., Laramie, Wyoming.

Bureau of Land Management. 1978. Second and Third Sand Creeks watershed plan. Unpublished report.

______. 1979. Final Environmental Statement: Proposed Coal Leasing in Carbon Basin Area, Wyoming. U.S. Department of the Interior, Bureau of Land Management.

______. 1985a. Manual 9113 - Roads. Engineering, Rel. 9-247. U.S. Department of the Interior, Bureau of Land Management.

______. 1985b. Fencing. BLM Manual Handbook H-1741-1. U.S. Department of the Interior, Bureau of Land Management.

______. 1987a. Draft Resource Management Plan/Environmental Impact Statement for the Medicine Bow-Great Divide Resource Area, Rawlins District, Wyoming, BLM-WY-ES-87-008-4410. U.S. Department of the Interior, Bureau of Land Management. 500 pp.

______. 1987b. Green River Hams Fork Data Adequacy Standards.

______. 1988. National Environmental Policy Act handbook, H-1790-1. U.S. Department of the Interior, Bureau of Land Management.

______. 1990. Great Divide Resource Area Record of Decision and Approved Resource Management Plan, BLM-WY-PT-91-010-4410. U.S. Department of the Interior, Bureau of Land Management, Great Divide Resource Area, Rawlins District, Wyoming. 74 pp.

______. 1991. Wyoming supplement to the Bureau 9113 Manual. U.S. Department of the Interior, Bureau of Land Management, Wyoming State Office. 16 pp.

______. 1993. Final environmental impact statement for the Medford Hanna Basin coalbed methane project, Carbon County, Wyoming. U.S. Department of the Interior, Bureau of Land Management, Great Divide Resource Area, Rawlins District, Rawlins, Wyoming, by Mariah Associates, Inc., Laramie, Wyoming.

______. 1994a. Guidelines for Analyzing and Documenting Cumulative Impacts. Information Bulletin No. 94-310, April 12, 1994. United States Department of the Interior, Bureau of Land Management, Washington, D.C. 42 pp. + attach/append.

______. 1994b. Unpublished raptor nest and sage grouse lek locations. U.S. Department of the Interior, Bureau of Land Management, Rawlins, Wyoming.

______. 1995a. Draft KENETECH/PacifiCorp Windpower Project Environmental Impact Statement. Prepared by TRC Mariah Associates Inc., Laramie, Wyoming. DES 95-2.

______. 1995b. Final KENETECH/PacifiCorp Windpower Project Environmental Impact Statement. Prepared by TRC Mariah Associates Inc., Laramie, Wyoming. FES 95-29.

______. 1996. Overview of BLM's NEPA Process. Bureau of Land Management, National Training Center Course Number 1620-02.

______. 1997a. Environmental Assessment for Coal Planning Decisions in the Carbon Basin Area of the Great Divide Resource Area. U.S. Department of the Interior, Bureau of Land Management, Great Divide Resource Area. 84 pp. + append. BLM/WY/PL97/025+1320.

______. 1997b. Record of Decision, SeaWest/PacifiCorp Windpower Project. U.S. Department of the Interior, Bureau of Land Management, Rawlins District. 56 pp. + attachments.

______. 1997c. Final Environmental Impact Statement for the North Rochelle Coal Lease Application. Prepared by TRC Mariah Associates Inc., Laramie, Wyoming.

______. 1998a. Decision record for the environmental assessment for coal planning decisions in the Carbon Basin area of the Great Divide Resource Area. U.S. Department of the Interior, Bureau of Land Management, Rawlins District. 10 pp. + errata

______. 1998b. Final Environmental Impact Statement, Jonah Field II Natural Gas Project. U.S. Department of the Interior, Bureau of Land Management, Rock Springs District, Pinedale and Green River Resource Areas. Rock Springs, Wyoming. BLM/WY/PL-97/015+1310.

Bystrak, D. 1983. Loggerhead shrike (*Lanius ludovicianus*) *In* J.S. Armbruster (ed.), Impacts of coal surface mining on 25 migratory bird species of high federal interest. Department of the Interior, U.S. Fish and Wildlife Service, FWS/OBS-83/35. 348 pp.

Call, M.W. 1978. Nesting habitats and surveying techniques for common western raptors. U.S. Department of the Interior, Bureau of Land Management, Technical Note No. 316. 115 pp.

Case, G.R. 1987. A new selachian fauna from the late Campanian of Wyoming (Teapot Sandstone Member, Mesaverde Formation, Big Horn Basin). Palaeontographica. Abteilung A: Palaeozoologie-Stratigraph, v. 197, p. 1-37.

Case, J.C. 1986. Earthquakes and related geologic hazards in Wyoming. Geological Survey of Wyoming, Public Information Circular No. 26. 22 pp.

______. 1990. Geologic hazards in Wyoming, earthquakes. Wyoming Geo-notes No. 28, Wyoming Geological Survey, Laramie. 44 pp.

______. 1994. Earthquakes in Wyoming, 1991-1993. Wyoming Geo-notes No. 41, Wyoming Geological Survey, Laramie. pp. 49-53.

315

Case, J.C., L.L. Larsen, C.S. Boyd, and J.C. Cannia. 1990. Earthquake epicenters and suspected active faults with surficial expression in Wyoming. Geological Survey of Wyoming Open File Report 90-10. Map.

Chervik, T.M. 1991. Big game animal crossing study along an overland coal conveyor structure in Northwest Colorado. Pages 112-119 *In* Issues and Technology in the Management of Impacted Wildlife. Proceedings of a National Symposium, Snowmass Resort, Colorado. April 8-10, 1991.

Clark, T.W., and M.R. Stromberg. 1987. Mammals in Wyoming. University of Kansas, Museum of Natural History, Public Education Series No. 10. 314 pp.

Clemens, W.A., and J.A. Lillegraven. 1986. New Late Cretaceous, North American advanced therian mammals that fit neither the marsupial nor eutherian molds *In* Kathryn M. Flanagan and J.A. Lillegraven (eds.), Vertebrates, Phylogeny, and Philosophy, Contributions to Geology, University of Wyoming, Special Paper.

Colorado Department of Public Health and Environment. 1997. Background pollutant information on file at the Colorado Department of Public Health and Environment, Denver, Colorado.

Craig, R.B. 1978. An analysis of the predatory behavior of the loggerhead shrike. Auk 95(2):221-234.

Cunniff, P. 1977. Environmental Noise Pollution. John Wiley & Sons, Inc. New York.

Daddow, P.B. 1986. *Groundwater data through 1980 for the Hanna and Carbon Basins, South-central Wyoming.* U.S. Geological Survey Open File Report 85-628. 91 pp.

Deblinger, R.D. 1988. Ecology and behavior of pronghorn in the Red Desert, Wyoming, with reference to energy development. Ph.D. Dissertation, Colorado State University, Fort Collins, Colorado. 227 pp.

DeBruin, R.H., and C.S. Boyd. 1991. Oil and Gas Map of Wyoming. Geological Survey of Wyoming. Map.

Dinsmore, J.J. 1983. Mountain plover (*Charadrius montanus*). Pages 185-196 *In* J.S. Armbruster (ed.), Impacts of coal surface mining on 25 migratory bird species of high federal interest. Department of the Interior, U.S. Fish and Wildlife Service, FWS/OBS-83/35. 348 pp.

Dorn, J.L. and R.D. Dorn. 1990. Wyoming Birds. Mountain West Publishing, Cheyenne, Wyoming. 139 pp.

Eberle, J.J. 1994. Mammalian biostratigraphy in the Late Cretaceous-early Tertiary Ferris Formation of the Hanna Basin, southcentral Wyoming. A preliminary report. Society of Vertebrate Paleontology. 54th Annual Meeting. Abstracts of papers. Journal of Vertebrate Paleontology 14:3, Suppl. p. 23-24.

_____. 1995a. Mammalian evolution at the dawn of the Paleocene in the Hanna Basin, southcentral Wyoming. Geological Society of America. Rocky Mountain Section, 47th Annual Meeting. Abstracts with Programs - Geological Society of America. 24:4 p. 10.

_____. 1995b. Redefining interval zones of the Puercan land mammal age in the western Hanna Basin, southcentral Wyoming. Abstracts of papers. 55th Annual Meeting. Society of Vertebrate Paleontology. Journal of Vertebrate Paleontology 15:3, Suppl. p. 27.

_____. 1996. Lancian and Puercan mammalian biostratigraphy, systematics, and evolution in the western Hanna Basin, southcentral Wyoming. Ph.D. Dissertation, University of Wyoming, Laramie. 400 pp.

Eberle, J.J., and A.F. Wroblewski. 1996a. Evolution of latest Cretaceous-earliest Tertiary depositional environments in the Western Hanna Basin, Wyoming *In* Geological Society of America, Rocky Mountain Section, 48th Annual Meeting. Abstracts with Programs Geological Society of America. 28:4 p. 42.

_____. 1996b. Mammalian biostratigraphy as a means of calculating earliest paleocene rates of sedimentation and basin subsidence in the western Hanna Basin, Wyoming. Geological Society of America, Rocky Mountain Section, 48th Annual Meeting, abstracts with programs. Abstracts with Programs, Geological Society of America 28:4. p. 7.

Edison Development Company. 1983. Soil Assessment: Carbon Basin Mine Area. Prepared by Land Resources Technology Inc., Laramie, Wyoming. Revised March 1983.

Edwards, C.C. 1969. Winter behavior and population dynamics of American eagles in Utah. Ph.D. Dissertation, Brigham Young University, Provo, Utah. 156 pp.

Environmental Protection Agency. 1988. Control of fugitive dust sources. EPA-450/3-88-008. Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina.

_____. 1993. Supplement F to Compilation of Air Pollutant Emission Factors. Volume I. Stationary Point and Area Sources. AP-42. July 1993.

Evans, D.L. 1983. Ferruginous hawk (*Buteo regalis*). Pages 109-123 *In* J.S. Armbruster (ed.), Impacts of coal surface mining on 25 migratory bird species of high federal interest. Department of the Interior, U.S. Fish and Wildlife Service, FWS/OBS-83/85. 348 pp.

Federal Emergency Management Agency. 1987. Federal emergency management agency maps for Carbon County.

Federal Highway Administration. 1978. Manual on Uniform Traffic Control Devices for Streets and Highways. U.S. Department of Transportation, Federal Highway Administration. U.S. Government Printing Office, Washington, D.C.

Fertig, W. 1997. Wyoming Plant and Animal Species of Special Concern. Wyoming Natural Diversity Database, Laramie. 32 pp.

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Forrest, S.C., T.W. Clark, L. Richardson, and T.M. Campbell III. 1985. Black-footed ferret habitat: Some management and reintroduction considerations. Wyoming Bureau of Land Management Wildlife Technical Bulletin No. 2. 49 pp.

Frey, A.H. 1993. Electromagnetic Field Interactions with Biological Systems. Federation of American Societies for Experimental Biology Journal. 7:272-281.

Frison, G.C. 1978. Prehistoric Hunters of the High Plains. Academic Press, New York.

Garbarino, M.S. 1976. Native American Heritage. Little, Brown and Company, Boston.

Gardner, A.D., and V.R. Flores. 1989. Forgotten Frontier: A History of Wyoming Coal Mining. Westview Press, Boulder, San Francisco, and London.

Gardner, A.D., D.E. Johnson, and M.J. Christiansen. 1985. Archaeological and Historical Survey of 31 Mine Reclamation Sites in Albany and Carbon Counties, Wyoming. Prepared for Wyoming Department of Environmental Quality by Archaeological Services, Western Wyoming College, Rock Springs, Wyoming.

Gilbert, P.F., O.C. Wallmo, and R.B. Gill. 1970. Effect of snow depth on mule deer in Middle Park, Colorado. Journal of Wildlife Management 34:15-23.

Gill, J.R., E.A. Merewether, and W.A. Cobban. 1970. Stratigraphy and nomenclature of some Upper Cretaceous and Lower Tertiary rocks in southcentral Wyoming. U.S. Geological Survey Professional Paper 667. 53 pp.

Glass, G.B. 1991. Minerals updated, coalbed methane, Wyoming Geo-notes No. 32. Geological Survey of Wyoming. 48 pp.

Glass, G.B., and R.W. Jones. 1991. Mineral resources of Wyoming. Wyoming Geological Association Guidebook, 42nd edition. 264 pp.

Glass, G.B., and J.T. Roberts. 1979. Remaining strippable coal resources and strippable reserve base of the Hanna coal field in southcentral Wyoming. Geological Survey of Wyoming Report Investigations 17. 166 pp.

Graber, R.R., J.W. Graber, and E.L. Kirk. 1973. Illinois birds: Laniidae. Illinois Natural History Survey, Biological Notes 93. 18 pp.

Graul, W.D. 1973. Breeding adaptations of the mountain plover (*Charadrius montanus*). Ph.D. Dissertation, University of Minnesota. 165 pp. + append.

Graul, W.D., and L.E. Webster. 1976. Breeding status of the mountain plover. Condor 78:265-267.

Greer, R. n.d. Sage grouse habitat requirements and development. Wyoming Game and Fish Department, Habitat Extension Services, Habitat Extension Bulletin No. 31. 6 pp.

Guenzel, R.J. 1986. Pronghorn ecology in southcentral Wyoming. M.S. Thesis, University of Wyoming, Laramie. 347 pp.

Gumtow, R. 1994. Draft 1994 Wyoming Water Quality Assessment. Wyoming Department of Environmental Quality, Water Quality Division, Cheyenne, Wyoming. 305 pp.

Halls, L.K. 1978. White-tailed deer. Pages 43-65 *In* J.L. Schmidt and D.L. Gilbert (eds.), Big Game of North America: Ecology and Management, Stackpole Books, Harrisburg, Pennsylvania. 494 pp.

Hansen, D.E. 1986. Laramide tectonics and deposition of the Ferris and Hanna Formations, southcentral Wyoming *In* J.A. Peterson (ed.), Paleotectonics and sedimentation in the Rocky Mountain Region, United States. AAPG Memoir 41. pp. 481-495.

Harris, R.E., W.D. Hausel, and J.E. Meyer. 1985. Metallic and industrial minerals map of Wyoming. Geological Survey of Wyoming. Map Series 14.

Harris, R.E., and J.E. Meyer. 1986. Construction materials map of Wyoming. Geological Survey of Wyoming. Map Series 21.

Harvey, F.M. 1998. State Materials Engineer, Wyoming Department of Transportation, Cheyenne. Letter dated February 27, 1998, to J. Gould, District Engineer, Wyoming Department of Transportation, Laramie. Copy of letter provided to Roger Schoumacher, TRC Mariah Associates Inc., Laramie, Wyoming.

Hausel, W.D., G.G. Marlatt, E.L. Nielsen, and R.W. Gregory. 1994. Study of Metals and Precious Stones in Southern Wyoming. Wyoming State Geological Survey Open File Report 94-2. Laramie, Wyoming. 61 pp.

Howe, M.A. 1983. Long-billed curlew (*Numenius americanus*). Pages 197-211 *In* J.S. Armbruster (ed.), Impacts of coal surface mining on 25 migratory bird species of high federal interest. Department of the Interior, U.S. Fish and Wildlife Service, FWS/OBS-83/35. 348 pp.

Hyden, H.J., and H. McAndrews. 1967. Geologic Map of the TL Ranch Quadrangle, Carbon County, Wyoming. U.S. Geological Survey Geological Quadrangle Map GQ-637, 1:24,000.

Intermountain Resources, Inc. 1996. Final reclamation bond release study, Arch of Wyoming, Seminoe I Mine, Permit 318-T2. Prepared by Intermountain Resources, Laramie, Wyoming. Available at the Wyoming Department of Environmental Quality, Land Quality Division, Cheyenne, Wyoming.

_____. 1997. Unpublished January 1997-September 1997 field data compiled and provided to TRC Mariah Associates by Jim Orpet, Intermountain Resources for Arch of Wyoming.

Johnson, G.D., D.P. Young, Jr, W.P. Erikson, M.D. Strickland, C.E. Derby, and J.W. Kern. 1997. Draft 1995 Wildlife Monitoring Studies, SeaWest Windpower Plant, Carbon County, Wyoming. Prepared for SeaWest Energy Corporation, San Diego, California, and U.S. Department of the Interior, Bureau of Land Management, Rawlins District Office, Rawlins, Wyoming, by Western EcoSystems Technology, Inc., Cheyenne, Wyoming. 154 pp.

Karafakis, M.G. n.d. Mechanisms for subsidence over abandoned coal mines. Unpublished manuscript. Civil Engineering Department, University of Wyoming, Laramie.

Kauffman, E.G. 1977. Illustrated guide to biostratigraphically important Cretaceous macrofossils, Western Interior Basin, U.S.A. The Mountain Geologist, v. 14. p. 225-274.

Keefer, W.D. 1972. Frontier, Cody, and Mesaverde Formations in the Wind River and Southern Bighorn Basins, Wyoming. U.S. Geological Survey Professional Paper 495-D. 22 pp.

Laun, H.C. 1957. A life history study of the mountain plover, *Eupoda montana*, Townsend, on the Laramie Plains, Albany County, Wyoming. M.S. Thesis, University of Wyoming, Laramie. 67 pp.

Lillegraven, J.A. 1995. Nature, timing, and paleogeographic consequences of Laramide deformation in the northeastern Hanna Basin, Wyoming. AAPG Rocky Mountain Section meeting abstracts. AAPG Bulletin 79:6, p. 921.

Lillegraven, J.A., and M.C. McKenna. 1986. Fossil Mammals from the "Mesaverde" Formation (Late Cretaceous, Judithian) of the Bighorn and Wind River Basins, Wyoming, with Definitions of Late Cretaceous North American Land-Mammal "Ages". American Museum Novitates, v. 2840, 68 pp.

Liu, W. 1997. Analyst, Wyoming Division of Economic Analysis, Cheyenne. Personal communication on September 2, 1997. Contacted by Roger Schoumacher, TRC Mariah Associates Inc., Laramie, Wyoming.

Love, J.D., and A.C. Christiansen. 1985. Geologic Map of Wyoming Department of the Interior, U.S. Geological Survey, Denver, Colorado.

Lowry, M.E., S.J. Rucker, IV, and K.L. Wahl. 1973. Water resources of the Laramie, Shirley, Hanna, and adjacent areas, southeastern Wyoming. U.S. Geological Survey Atlas HA-471. 4 plates.

Luce, B., B. Oakleaf, A. Cerovski, L. Hunter, and J. Priday. 1997. Atlas of Birds, Mammals, Reptiles and Amphibians In Wyoming. Wyoming Game and Fish Department, Wildlife Division, Cheyenne, Wyoming. 192 pp.

Lull, R.S. 1933. A revision of the Ceratopsia or horned dinosaurs. Peabody Museum of Natural History, Memoirs, v. 3. pp. 1-175.

Lyon, L.J., and A.L. Ward. 1982. Elk and land management. Pages 443-477 *In* J.W. Thomas and D.E. Toweill (eds.), Elk of North America: Ecology and Management. Stackpole Books, Harrisburg, Pennsylvania. 698 pp.

Mariah Associates, Inc. 1989. Wildlife monitoring and raptor nesting research report for the Medicine Bow Mine, Carbon County, Wyoming. Prepared for Arch of Wyoming, Inc., Hanna, Wyoming, by Mariah Associates, Inc., Laramie, Wyoming. 21 pp. + append.

Martner, B.E. 1981. Wind characteristics in southern Wyoming Part I: Surface Climatology. Department of Atmospheric Sciences, University of Wyoming, Laramie. 117 pp.

_____. 1986. Wyoming Climate Atlas. University of Nebraska Press, Lincoln, Nebraska. 432 pp.

Martner, B.E., and J.D. Marwitz. 1982. Wind characteristics in southern Wyoming. Journal of Applied Meteorology. 21:1,815-1,827.

Marwitz, J.D., and B.E. Martner. 1981. Wind characteristics in southern Wyoming, Part IV: executive summary. Report No. AS 130, Department of Atmospheric Science, University of Wyoming, Laramie. 43 pp.

Massey, R. 1990. Wyoming's Comprehensive Historic Preservation Plan. State Historic Preservation Office, Department of Commerce, Cheyenne, Wyoming.

McCafferty, E. 1930. Annotated and distributional list of birds of Wyoming. M.S. Thesis, University of Wyoming, Laramie. 288 pp.

Mesilla Valley Engineers, Inc. 1977. Surface Mine Permit Report, Carbon Basin Project, Carbon County, Wyoming. Vol. II. Prepared for Morrison-Knudsen Company, Inc. and Nuclear Resources Company, Inc., Mesilla Park, New Mexico.

Morrison-Knudsen Company, Inc. 1977. Surface Mine Permit Report, Carbon Basin Project, Carbon County, Wyoming. Prepared for Commonwealth Edison, Inc. by Morrison-Knudsen Company, Inc., Boise, Idaho. Vols. 1-4.

_____. 1983. Appendix D5: Topography, Geology, and Overburden, Carbon Basin Mine. Prepared for Edison Development Company, Hanna, Wyoming by Morrison-Knudsen Company, Inc., Boise, Idaho. 31 pp.

Mulloy, W.T. 1958. A Preliminary Historical Outline for the Northwestern Plains. University of Wyoming Publications in Science. 18(1):1-70 Laramie, Wyoming.

National Acid Rain Precipitation Assessment Program. 1993. 1992 report to Congress. 130 pp.

Natural Resources Conservation Service. 1970. Order 3 Soil Survey of the Carbon Basin. Unpublished data. On file at the Natural Resource Conservation Service, Saratoga, Wyoming.

Oakleaf, B., A.O. Cerovski, and B. Luce. 1996. Nongame Bird and Mammal Plan, October 1996. Prepared for the Nongame Program, Biological Services Section, Wyoming Game and Fish Department. 183 pp.

Oberholtzer, M. 1985. A comprehensive survey of the Medicine Bow River drainage. Tributary to the North Platte River, Carbon County, Wyoming. Wyoming Game and Fish Department, Fish Division, Completion Report. 112 pp.

Oedekoven, O.O., and F.G. Lindzey. 1987. Winter habitat-use patterns of elk, mule deer, and moose in southwestern Wyoming. Great Basin Naturalist 47(4):638-643.

Olendorff, R.R., A.D. Miller, and R.N. Lehman. 1981. Suggested Practices for Raptor Protection on Power Lines - The State of the Art in 1981. Raptor Research Report No. 4, Raptor Research Foundation, Inc., Hastings, Minnesota. 111 pp.

PacifiCorp. 1994. Micro-analysis of 230 kV powerline and related environmental concerns from Miner's substation near Hanna, Wyoming to KENETECH's Wyoming Windplant project, BLM-WY-130382, PP&L WYW-130929. 36 pp.

Parrish, T.L. 1988. Mountain plover habitat selection in the Powder River Basin, Wyoming. M.S. Thesis, University of Wyoming, Laramie. 60 pp.

Pedersen Planning Consultants. 1997. Carbon County Land Use Plan. A report to the Carbon County Board of Commissioners from the Carbon County Planning Commission. Prepared by Pedersen Planning Consultants, Saratoga, Wyoming

Peterson, A. 1986. Habitat suitability index models: Bald eagle (breeding season). U.S. Fish and Wildlife Service Biological Report 82(10.126). 25 pp.

Priday, J. and R.J. Luce. 1995. Inventory of bats and bat habitat associated with caves and mine in Wyoming. *In* Endangered and Nongame Bird and Mammal Investigations, pp. 72-131. Wyoming Game and Fish Department, Cheyenne. 242 pp.

Public Utility Commission of Texas. 1992. Health effects of exposure to powerline-frequency electric and magnetic fields. Public Utility Commission of Texas, Electro-magnetic Health Effects Committee, Austin, Texas.

Rahn, P.H. 1976. Potential of coal strip-mine spoils as aquifers in the Powder River Basin, Old West Regional Commission, Old West Project 10470025. Billings, Montana.

Richter, H.R., Jr. 1981. Occurrence and characteristics of groundwater in the Laramie, Shirley, and Hanna Basins, Wyoming, Volume III-A. Report to the U.S. Environmental Protection Agency, Contract No. G-008269-79. 117 pp.

Rothenmaier, D. 1979. Sage grouse reproductive ecology: Breeding season movements, strutting ground attendance and site characteristics, and nesting. M.S. Thesis, University of Wyoming, Laramie. 97 pp.

Russell, R.O. 1990. Checklist of North American birds: United States and Canada, including Hawaii. Tucson Audubon Society, Tucson, Arizona. 27 pp.

Ryan, J.D. 1977. Late Cretaceous and Early Tertiary provenance and sediment dispersal, Hanna and Carbon Basins, Carbon County, Wyoming. Geological Survey of Wyoming Preliminary Report 16. 17 pp.

Ryder, T.J., and L.L. Irwin. 1987. Winter habitat relationships of pronghorns in southcentral Wyoming. Journal of Wildlife Management 51(1):79-85.

Sacramento Municipal Utility District. 1993. SMUD-Solano Wind Project Draft Environmental Report. Prepared by Sacramento Municipal Utility District. 142 pp. + append.

Schmidt, M. 1997. Superintendent and Board Secretary, Carbon County School District No. 1, Rawlins. Personal communication on November 6, 1997. Contacted by Roger Schoumacher, TRC Mariah Associates Inc., Laramie, Wyoming.

Schneider, E.A., W.W. Martin, W.M. Harding, J.D. Marmor, R. Weathermon, and B.R. McClelland. 1995. *Blowing in the Wind: A Class III Cultural Resource Inventory of Foote Creek Rim, Carbon County, Wyoming*. Report by TRC Mariah Associates, Inc. for KENETECH Windpower, Inc.

Scott, S.L. (ed.). 1987. Field guide to the birds of North America. Second edition. National Geographic Society, Washington, D.C. 464 pp.

Secord, R. 1996. Paleocene mammalian biostratigraphy of the Carbon Basin, southeastern Wyoming, and age constraints on local tectonism. M.S. thesis, Department of Geology and Geophysics, University of Wyoming, Laramie.

_____. 1997. Personal communication to G.F. Winterfeld including comments of paleontology of the Hanna Formation, dated June, 1997.

Seiersen, P.J. 1981. Historical Survey of East-central Carbon County in the Vicinity of the Project Area. *In* 1980 Cultural Resource Inventory and Limited Testing in the Carbon Basin, Carbon County, Wyoming for Energy Development Company. Metcalf Zier Archaeologists, Inc., Eagle, Colorado.

Sheets, R.G., R.L. Linder, and R.B. Dahlgren. 1972. Food habits of two litters of black-footed ferrets in South Dakota. American Midland Naturalist 87:249-251.

Sherrod, S.K. 1978. Diets of North American Falconiformes. Raptor Research 12(3/4):49-121.

Shapurji, S.S. 1978. Depositional Environments and Correlation of the Mesaverde Formation, Wind River Basin, Wyoming *In* Resources of the Wind River Basin, Wyoming Geological Associations 30th Annual Field Conference Guidebook. p. 167-180.

Smith, H.M., and E.D. Brodie, Jr. 1982. Reptiles of North America. Western Publishing Company, Inc., Racine, Wisconsin. 240 pp.

Snow, C. 1972. Habitat management series for endangered species. Report No. 1: American peregrine falcon (*Falco peregrinus anatum*) and arctic peregrine falcon (*F. p. tundrius*). U.S. Department of the Interior, Bureau of Land Management, Technical Note No. 167. 35 pp.

_____. 1973. Habitat management series for endangered species. Report No. 5: Southern bald eagle (*Haliaeetus leucocephalus leucocephalus*) and northern bald eagle (*H. l. alascanus*). U.S. Department of the Interior, Bureau of Land Management, Technical Note No. 171. 58 pp.

Soil Conservation Service. 1988. Technical guide, section IIB, 10-14" High Plains Southeast.

Stebbins, R.C. 1966. A Field Guide to Western Reptiles and Amphibians: Field Marks of All Species in Western North America. Houghton Mifflin Company, Boston. 279 pp.

Steenhof, K. 1978. Management of wintering bald eagles. U.S. Fish and Wildlife Service, FWS/OBS-78/79. 59 pp.

Stubbs, D. 1997. Carbon County Assessor, Rawlins. Personal communication on November 4, 1997. Contacted by Roger Schoumacher, TRC Mariah Associates Inc., Laramie, Wyoming.

Thomas, D.M., J.M. Ward, and R. Pickering. 1997. Final Baseline Avian Studies for the Proposed SeaWest Energy Corporation Wyoming Wind Plant. Prepared for SeaWest Energy Corporation and U.S. Department of the Interior, Bureau of Land Management, Great Divide Resource Area, Rawlins, Wyoming, by TRC Mariah Associates Inc., Laramie, Wyoming. 128 pp. + append.

Tipler, P.A. 1991. Physics for Scientists and Engineers. Third Edition. Published by P.A. Tipler. 1,167 pp. + append.

TRC Mariah Associates Inc. 1995. Unpublished 1994-1995 wildlife observation data for the KENETECH Windplant Project. Available at TRC Mariah Associates Inc., Laramie, Wyoming.

_____. 1997. Final SeaWest/KENETECH Windfarm Development Comparison, Carbon County, Wyoming. Prepared for Bureau of Land Management, Rawlins District Office, Rawlins, Wyoming. 107 pp. + append.

Trewartha, G.T., and L.H. Horn. 1980. An Introduction to Climate. McGraw Hill, Inc., New York. 416 pp.

Union Pacific Coal Company. 1940. *History of the Union Pacific Coal Mines, 1868-1940.* The Colonial Press, Omaha, Nebraska.

Union Pacific Railroad Company. n.d. Unpublished map.

University of Wyoming. 1991. Carbon County Land Use Inventory. Department of Geography and Recreation, Planning Program. University of Wyoming, Laramie. 32 pp.

_____. 1996. Draft Report. Southwest Wyoming Bureau of Land Management planning area (including Wyoming counties of Carbon, Lincoln, Sublette, Sweetwater, and Uinta). Recreation on BLM lands in southwest Wyoming, per unit economic values for outdoor recreation, big game hunting in southwest Wyoming, Wyoming mineral tax revenue from southwest Wyoming, southwest Wyoming payments-in-lieu of taxes (PILT), economic impacts per unit of economic activity. College of Agriculture, Cooperative Extension Service, University of Wyoming, Laramie, Wyoming.

U.S. Congress, Office of Technology Assessment. 1991. Changing by degrees: steps to reduce greenhouse gases, OTA-0-482 (Washington, D.C.: U.S. Government Printing Office, February 1991). 354 pp.

U.S. Department of the Interior. 1980. Department Manual 516, Environmental Quality.

U.S. Fish and Wildlife Service. 1988. Black-footed ferret recovery plan. U.S. Fish and Wildlife Service, Denver, Colorado. 154 pp.

_____. 1989. Black-footed ferret survey guidelines for compliance with the Endangered Species Act. U.S. Fish and Wildlife Service, Denver, Colorado, and Albuquerque, New Mexico. April 1989. 10 pp. + append.

_____. 1995. List of Species of Management Concern--1995 (U.S. Fish and Wildlife Service Region 6).

_____. 1996. Letter to Karla K.H. Swanson, Area Manager, Great Divide Resource Area, Bureau of Land Management, Rawlins, Wyoming, from Charles P. Davis, Field Supervisor, Ecological Services, Cheyenne, Wyoming (ES-61411, kd/W.02[arkland.scp]). December 16, 1996.

_____. 1997. Letter to Karla K.H. Swanson, Area Manager, Great Divide Resource Area, Bureau of Land Management, Rawlins, Wyoming, from Pete Ramirez, Acting Field Supervisor, Ecological Services, Cheyenne, Wyoming (ES-61411, kd/W.02[arkland2.scp]). August 11, 1997.

U.S. Forest Service. 1994a. Record of Decision for the Mountain Plover Management Strategy. U.S. Department of Agriculture, Forest Service, Pawnee National Grassland, Arapaho and Roosevelt National Forests, Weld County, Colorado. 23 pp.

_____. 1994b. Final Environmental Impact Statement for Management Strategy for Mountain Plover. U.S. Department of Agriculture, Forest Service, Pawnee National Grassland, Arapaho and Roosevelt National Forests, Weld County, Colorado.

U.S. Geological Survey. 1994. Unpublished data.

Van Voast, W.A. 1978. Hydrologic effects of strip coal mining in southeastern Montana--Emphasis: 1 year of mining near Decker. Montana Bureau of Mines and Geology Bulletin 93.

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Vaughn Hansen Associates, Inc. 1982. Appendix D6: Hydrology, Carbon Basin Mine. Prepared for Energy Development Company, Hanna, Wyoming, by Vaughn Hansen Associates, Inc., Salt Lake City, Utah. 175 pp.

Verplancke, M. 1997. Administrative Secretary, Carbon County School District No. 2, Saratoga. Personal communication on November 6, 1997. Contacted by Roger Schoumacher, TRC Mariah Associates Inc., Laramie, Wyoming.

VTN Colorado. 1978. Final Environmental Baseline Report for Commonwealth Edison and Morrison-Knudsen, Inc. Carbon Basin Project, Section 5 Soil Study. Prepared by VTN, Colorado, Inc. January 20, 1978.

Wakkinen, W.L., K.P. Reese, and J.W. Connelly. 1992. Sage grouse nest locations in relation to leks. Journal of Wildlife Management 56(2):381-383.

Wallestad, R. 1975. Life History and Habitat Requirements of Sage Grouse in Central Montana. Game Management Division, Montana Department of Fish and Game, in cooperation with U.S. Department of the Interior, Bureau of Land Management. 55 pp.

Wallestad, R., and D. Pyrah. 1974. Movement and nesting of sage grouse hens in central Montana. Journal of Wildlife Management 38(4):630-633.

Weishampel, D.B. 1992. Dinosaurian Distribution *In* D.B. Weishampel, P. Dodson, and H. Osmolska (eds.), The Dinosauria, University of California Press, Berkeley. p. 63-139.

Welch, J.M. 1985. Class III Cultural Resource Inventory for Forgren-Perkins Engineering Projects AML-7B-1 and AML-7B-2, Carbon County, Wyoming. Frontier Archaeology, Worland, Wyoming.

Western EcoSystems Technology, Inc. 1997. Unpublished sage grouse lek and raptor nest data collected for the SeaWest Wind Plant, Carbon County, Wyoming. Provided to D. Thomas by Western EcoSystems Technology, February 1998.

———. 1998. Draft Report, Wildlife Monitoring Studies, SeaWest Windpower Plant, Carbon County, Wyoming, 1995-1997. Prepared for SeaWest Energy Corporation, San Diego, California, and U.S. Department of the Interior, Bureau of Land Management, Rawlins District Office, Rawlins, Wyoming, by Western EcoSystems Technology, Inc., Cheyenne, Wyoming. 176 pp.

Whittie, W. 1997. Engineering Tech Senior, Wyoming Department of Transportation, Cheyenne. Personal communication on December 29, 1997. Contacted by Roger Schoumacher, TRC Mariah Associates Inc., Laramie, Wyoming.

Wiens, J.A., and M.I. Dyer. 1975. Rangeland avifaunas: Their composition, energetics, and role in the ecosystem. Pages 146-181 *In* D.R. Smith, Technical Coordinator. Symposium on management of forest and range habitat for nongame birds. U.S. Forest Service General Technical Report WO-1.

Wilderness Research Institute. 1979. A peregrine falcon nesting habit survey in the Shasta-Trinity National Forest. Wilderness Research Institute, Arcata, California. 22 pp.

Winterfeld, G. 1997. Paleontologic Inventory and Evaluation, Arch of Wyoming, Carbon Basin Coal Project, Carbon County, Wyoming. Prepared for TRC Mariah Associates Inc., Laramie, Wyoming and Arch of Wyoming, Hanna, Wyoming.

Wroblewski, A.F. 1995. First report of changes in lower vertebrate faunas across the Cretaceous-Tertiary boundary, western Hanna Basin, Wyoming *In* Abstracts of Papers, 55th Annual Meeting, Society of Vertebrate Paleontology. Journal of Vertebrate Paleontology. v. 15. p. 61.

Wyoming Department of Administration and Information. 1996. The equality state almanac, 1996. 4th edition. Department of Administration and Information, Division of Economic Analysis. Cheyenne, Wyoming. 119 pp.

Wyoming Department of Agriculture. n.d. Explanation of standard potable water analysis. Wyoming Department of Agriculture Analytical Services, Laramie.

Wyoming Department of Employment. 1996. Wyoming 1995 annual covered employment and wages. Wyoming Department of Employment, Research and Planning Section. Casper, Wyoming. 180 pp.

Wyoming Department of Environmental Quality, Air Quality Division. 1989. Wyoming air quality standards and regulations. Wyoming Department of Environmental quality, Division of Air Quality, Cheyenne, Wyoming. 88 pp.

_____. 1997. Background pollutant information on file at the Wyoming Department of Environmental Quality, Cheyenne, Wyoming.

Wyoming Department of Environmental Quality, Land Quality Division. 1987. Guideline No. 5, Wildlife. 17 pp.

_____. 1990. Guideline No. 8, Hydrology. 53 pp.

_____. 1996. Coal rules and regulations. Wyoming Department of Environmental Quality, Land Quality Division, Cheyenne, Wyoming.

Wyoming Department of Environmental Quality, Water Quality Division. 1990. Water quality rules and regulations. Wyoming Department of Environmental Quality, Cheyenne, Wyoming.

Wyoming Department of Revenue. 1997. 1997 annual report. Wyoming Department of Revenue, Cheyenne, Wyoming.

Wyoming Employment Resources Division. 1997. Wyoming labor force trends. Volume 34, Number 11, November 1997. Page 18.

Wyoming Game and Fish Department. 1990. Wick Wildlife Habitat Area. Pamphlet published by Wyoming Game and Fish Department, Cheyenne, Wyoming.

_____. 1991. Wyoming trout stream classification map. Wyoming Game and Fish Department, Cheyenne, Wyoming.

_____. 1994. Wyoming observation system records. Biological Services, Wyoming Game and Fish Department, Cheyenne, Wyoming.

_____. 1995. Laramie Region Annual Big Game Herd Unit Reports, 1994. Wyoming Game and Fish Department, Cheyenne, Wyoming.

_____. 1997a. Laramie Region Annual Big Game Herd Unit Reports, 1996. Wyoming Game and Fish Department, Cheyenne, Wyoming. 495 pp.

_____. 1997b. Wyoming Game and Fish Department Wildlife Observation System Database printout, generated for Jim Orpet, Intermountain Resources, July 28, 1997.

_____. n.d. Standardized definitions for seasonal wildlife ranges. Mimeograph. 2 pp.

Wyoming Game and Fish Department and Bureau of Land Management. 1991. A cooperative management plan for black-footed ferrets, Shirley Basin/Medicine Bow, Wyoming. Prepared by Shirley Basin/Medicine Bow Black-footed Ferret Working Group. Published by Wyoming Game and Fish Department, Cheyenne, Wyoming.

Wyoming Natural Diversity Database. 1997. Database search conducted for Diane Thomas, TRC Mariah Associates, Inc. by Laura Gleason, Administrative and Database Assistant, August 20, 1997.

Wyoming Oil and Gas Conservation Commission. 1996. State of Wyoming Oil and Gas Conservation Commission 1995 Statistical Summaries. 459 pp.

Wyoming State Engineer's Office. 1998. Unpublished data.

Wyoming State Land Use Commission. 1979. Wyoming State Land Use Plan. Wyoming State Land Use Commission. 89 pp.

Wyoming Taxpayers Association. 1993. Wyoming property taxation. Wyoming Taxpayers Association, Cheyenne.

Wyoming Water Resources Center. 1997. Unpublished data.

Yoakum, J.D. 1978. Pronghorn. Pages 103-121 *In* J.L. Schmidt and D.L. Gilbert (eds.), Big Game of North America: Ecology and Management. Stackpole Books, Harrisburg, Pennsylvania. 494 pp.

7.2 ACRONYMS AND ABBREVIATIONS

ACE	U.S. Army Corps of Engineers
AML	Abandoned Mine Lands
AO	Authorized Officer
AQD	Wyoming Department of Environmental Quality, Air Quality Division
Arch	Arch of Wyoming
Ark	Ark Land Company
ARPA	Archaeological Resources Protection Act of 1979
AUM	Animal unit month
BEPA	Bald Eagle Protection Act
BLM	Bureau of Land Management
BTU	British Thermal Unit
CAS	Chemical Abstract Service Registry Number
CBCPA	Carbon Basin Coal Project Area
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
cfs	Cubic feet per second
CIAA	Cumulative impact analysis area
CO	Carbon monoxide
cu yd	Cubic yard(s)
dBA	A-weighted decibel(s)
EA	Environmental assessment
EC	Electrical conductivity
EIS	Environmental impact statement
EMF's	Electric and magnetic fields
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FCLAA	Federal Coal Leasing Amendment Act of 1976
FEMA	Federal Emergency Management Agency
FLPMA	Federal Land Policy and Management Act of 1976
gallons/day/ft^2	Gallons per day per square foot
GDRA	Great Divide Resource Area
gpm	Gallons per minute
HMMP	Hazardous Materials Management Plan
hp	Horsepower
I-25	Interstate Highway 25
I-80	Interstate Highway 80
kV	Kilovolt(s)
kwh	Kilowatt/hour
lb	Pound(s)
LBA	Lease-by-application
LOM	Life-of-mine
LQD	Wyoming Department of Environmental Quality, Land Quality Division
MBTA	Migratory Bird Treaty Act
mg/m^3	Milligrams per cubic meter

mg/l	Milligrams per liter
mi	Mile(s)
MLA	*Mineral Leasing Act of 1920, as amended*
mph	Miles per hour
MSHA	Mine Safety and Health Administration
NEPA	National Environmental Policy Act of 1969
NHPA	National Historic Preservation Act of 1966
NMHC	Nonmethane hydrocarbon
NO_x	Nitrogen oxides
NPDES	National Pollution Discharge Elimination System
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NWI	National Wetlands Inventory
OSM	U.S. Office of Surface Mining
PCB	Polychlorinated byphenyl
Pedersen	Pedersen Planning Consultants
Planning Review EA	*Environmental Assessment for Coal Planning Decisions in the Carbon Basin Area of the Great Divide Resource Area*
PM_{10}	Particulates ≤10 microns
PMZ	Primary Management Zone
POM	Polycyclic organic matter
PSD	Prevention of Significant Deterioration
R2P2	Resource Recovery and Protection Plan
RCA	Raptor concentration area
RMP	Resource Management Plan
ROD	Record of decision
ROW	Right-of-way
SAR	Sodium adsorption ration
SARA	Emergency Planning and Community Right-to-Know Act of 1986, as amended (known as "SARA Title III")
SHPO	State Historic Preservation Office
SMCRA	Surface Mining Control and Reclamation Act
SMUD	Sacramento Municipal Utility District
SO_2	Sulphur dioxide
SPCC	Spill Prevention Control and Countermeasure
SPPP	Stormwater Pollution Prevention Plan
sq	square
sq mi	square mile(s)
TCP	Traditional Cultural Property
TDS	Total dissolved solids
T&E	Threatened and endangered
TE&C	Threatened, endangered, and candidate
TEC&SC	Threatened, endangered, and candidate species and species of concern
tpy	tons per year
TRC Mariah	TRC Mariah Associates Inc.
TSP	Total suspended particulates
TSS	Total suspended solids

USC	U.S. Code
USDI	U.S. Department of the Interior
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UW	University of Wyoming
VOCs	Volatile organic compounds
VRM	Visual Resource Management
WDAI	Wyoming Department of Administration and Information
WDEQ	Wyoming Department of Environmental Quality
WDOE	Wyoming Department of Employment
WEST	Western EcoSystems Technology, Inc.
WGFD	Wyoming Game and Fish Department
WGS	Wyoming Geological Survey
WOGCC	Wyoming Oil and Gas Conservation Commission
WQD	Wyoming Department of Environmental Quality, Water Quality Division
WWRC	Wyoming Water Resources Center
WYNDD	Wyoming Natural Diversity Database

7.3 GLOSSARY

Access road All roads, exclusive of haul and light-use roads, utilized for the transportation of personnel, equipment, and small payloads of material within the permit area.

Acid drainage Water with a pH of less than 6.0 and in which total acidity exceeds total alkalinity, discharged from an active or inactive mine or from an area affected by mining and reclamation operations.

Acid-forming material Earth materials that contain sulfide minerals or other minerals which exist in a natural state, or, if exposed to air, water, or weathering processes, will cause acid conditions that may hinder plant establishment or create acid drainage.

Adjacent area Land located outside the permit area upon which air, surface water, groundwater, fish, wildlife, or other resources may reasonably be expected to be adversely impacted by mining or reclamation operations. Unless otherwise specified, this area shall be presumptively limited to lands within 0.5 mi of the proposed permit area.

Administrator The Administrator of the LQD.

Affect To conduct an activity which will impact land, air, or water resources so as to disturb the natural land surface.

Allotment An area of land designated and managed for grazing of livestock.

Alluvium Unconsolidated rock or soil material deposited by running water, including gravel, sand, silt, clay, and various mixtures of the same.

Ambient air quality Prevailing condition of the atmosphere at a given time; the outside air. All lands are categorized in one of the Prevention of Significant Deterioration (PSD) classes. Class I is the most restrictive and generally applies to specific national parks and monuments. No decrease in air quality is allowed under this class. Class II areas allow some decrease in air quality. Class III areas allow for a substantial decrease in air quality, such as is found in urban areas.

Approximate original contour That surface configuration achieved by backfilling and grading of the mined areas to that the reclaimed land surface closely resembles the general surface configuration of the land prior to mining and blends into and complements the drainage pattern of the surrounding terrain.

Archveyor™ A patented continuous mining machine and conveyor used to access deep but surface-minable coal more efficiently than with surface or underground mining methods.

Animal Unit Month (AUM) The amount of forage (number of acres) needed to sustain one mature cow and calf (up to 6 months old) for one month, one horse, or five sheep. Wildlife ratio: The forage necessary to sustain 9.6 antelope, 5.8 deer, or 1.9 elk for one month.

Applicant Any "person" seeking a permit, permit revisions renewal, transfer, or other approval to conduct mining and reclamation operations, or "person" seeking license to explore, but does not include subsidiaries or parents of the "person", as "person" is defined under W.S. § 35-11-103(a)(vi).

Aquifer A zone, stratum, or group of strata that stores and transmits water in sufficient quantities for a specific use. There are three aquifer types within the Carbon Basin--alluvial, water table, and artesian. (See Section 3.1.9.2 of this EIS for discussion).

Best available control technologies Equipment, devices, systems, methods, or techniques which are currently available and practicable, and will 1) prevent, to the extent possible, additional contributions of suspended solids to streamflow or runoff outside the affected land or permit area, but in no case shall contributions exceed requirements set by applicable state or federal laws, and 2) minimize, to the extent possible, disturbances and adverse impacts on fish, wildlife, and related environmental values, and achieve enhancement of those resources where practicable.

Bond A surety or self-bond instrument by which the permit applicant assures faithful performance of all requirements of the associated laws and regulations promulgated thereunder, and the provisions of the permit and license to mine. This term also includes any federal insured certificates of deposit, cash, government securities, or irrevocable letters of credit which the operator has deposited with the appropriate authorized agency in lieu of a surety bond or self-bond instrument.

Backhaul Returning material back over all or part of the same route (e.g., topsoil will be backhauled to regraded areas).

Backslope The face of the spoil or embankment sloping downward from the highest elevation to the toe.

Blading Clearing or scraping the area with mechanized equipment.

Bottomland Alluvial land next to a river.

Carbonaceous shale Shale which contains carbon.

Centerline The line down the center or a road or highway dividing it into separate sections for traffic moving in opposite directions.

Coal exploration

1. The field gathering of surface or subsurface geologic, physical, or chemical data by mapping, trenching, drilling, geophysical, or other techniques necessary to determine the quality an quantity of overburden and coal of an area.

2. The gathering of environmental data to establish the conditions of an area before beginning surface coal mining and reclamation operations.

Coal mine waste Coal-processing waste and underground development waste.

Coal preparation plant A facility where coal is subjected to chemical or physical processing or cleaning, concentrating, or other processing or preparation. It includes facilities associated with coal preparation activities including, but not limited to, loading facilities; storage and stockpile facilities; sheds, shops, and other buildings; water treatment and storage facilities; settling basins and impoundments; and coal-processing and other waste disposal areas.

Coal-processing waste Earthen materials which are wasted or otherwise separated from product coal during cleaning, concentrating, or other processing or preparation of coal.

Coaly shale Shale deposits which contain or resemble coal.

Compaction The reduction of pore spaces among particles of soil or rock, generally done by controlled placement and running heavy equipment over the earthen material.

Comparison area A land unit which is representative in terms of physiography, soils, vegetation, and land use history, or a premining plant community from which no or insufficient vegetation data were collected prior to disturbance.

Control area A land unit which is representative, in terms of physiography, soils, vegetation, and land use history, of a plant community to be affected by mining activities as verified by a comparison of its quantitative and qualitative characteristics to similar information from the plant community it typifies, and where a mathematical climatic adjustment is made.

Corridor A strip of land (usually a few to many times the width of a right-of-way) within which one or more existing or potential facilities, travelways, conveyors, or power lines may be located.

Cover Vegetation, litter, and rock over the soil which intercept rainfall.

Critical habitat Those areas essential to the survival and recovery of species listed as threatened or endangered (50 CFR 17 and 226).

Crucial winter range Those areas which, during the winter months, determine a population's ability to maintain and reproduce itself at a certain level over the long-term.

Cultural Resources Those fragile and nonrenewable remains of human activity, occupation, or endeavor reflected in districts, sites, structures, buildings, objects, artifacts, ruins, works or art, architecture, and natural features that were of importance in human events. These resources consist of (1) physical remains, (2) areas where significant human events occurred--even though evidence of the event no longer remains, and (3) the environment immediately surrounding the resource.

Cultural Resource Inventory A descriptive listing and documentation, including photographs and maps, of cultural resources; included are the processes of locating, identifying, and recording sites, structures, buildings, objects, and districts through library and archival research, information from persons knowledgeable about cultural resources, and varying levels of intensity of on-the-ground field surveys.

Cultural Resource Site A physical location of past human activities or events. Cultural resource sites are extremely variable in size and range from the location of a single cultural resource object to a cluster of cultural resource structures with associated objects and features. Prehistoric and historic sites which are recorded as cultural resources have sociocultural or scientific values and meet the general criterion of being more than 50 years old.

Designated authorized representative Either the Administrator, the district engineer, or other qualified inspector designated by the Director who has the authority to issue a cessation order.

Decisionmakers The agencies, or designated representatives within the agencies, who must make the final decisions based upon the information presented in this EIS.

Developmental drilling Drilling down to and including the lowest coal seam to be mined which occurs in or within 500 ft of an active mine pit.

Dewatering To remove water from the coal seam.

Disturb To impact land or water resources by blasting; by destruction of the vegetative cover or removal of topsoil, subsoil, or overburden; by drilling coal exploratory holes; by digging pits; by construction of roads or other access routes; by placement of excavated earthen or waste material on the natural land surface or by other such activities; or to remove more than 250 tons of coal.

Diversion A channel, embankment, device, or other man-made structure constructed for the purpose of diverting water from one area to another.

Dragline An excavating crane having a bucket that is dropped from a boom and dragged toward the crane base by a cable. Also called a dragline crane.

Drill site All areas of land that are or will be disturbed or utilized by exploration drilling. This area includes drill holes or other drilled excavations, drilling pads, and areas disturbed by mud pits, and any land over which drilling mud mixtures overflow or may disturb.

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Drilling Exploratory action conducted to gather subsurface geologic, physical, or chemical data to determine the location, quantity, or quality of the natural mineral deposit of an area, excluding holes drilled for use as water wells.

Eligible lands All land to be affected by a mining operation after the shrub standard is approved by the OSM (see Section 5.1.2.4 of this EIS).

Embankment An artificial deposit of material that is raised above the natural surface of the land and used to contain, divert, or store water, support roads or railways, or other similar purposes.

Ephemeral stream A stream which flows only in direct response to precipitation in the immediate watershed or in response to snow melt, and which has a channel bottom that is always above the prevailing water table.

Excess spoil Spoil material disposed in a location other than the mine-out area, except that spoil material used to achieve the approximate original contour or to blend the mined-out area with the surrounding terrain.

Federal lands Lands owned by the U.S., without reference to how the lands were acquired or what federal agency administers the lands, including mineral estates underlying private surface.

Floodplain The nearly level alluvial plain that borders a stream and is subject to inundation (flooding) during high water.

Forage All browse and herbaceous foods that are available to grazing animals. It may be grazed or harvested for feeding. Browse is that part of the current leaf and twig growth of shrubs, woody vines, and trees available for animal consumption.

Good husbandry practices Sound land management techniques which are commonly practiced in the area of the mine considering the postmining land use and, if discontinued after the bond period ends, shall not reduce the probability of permanent vegetation success.

Groundwater Subsurface water that fills available openings in rock or soil materials such that they may be considered water-saturated.

Habitat The place where animals or plants normally live, often characterized by a dominant plant and co-dominant form (pinyon-juniper habitat).

Haul road All roads utilized for the transport of the extracted mineral, overburden, or other earthen materials

Hazardous materials Any material or substance which results from or is encountered in a mining operation which could reasonably be expected to cause physical harm if not controlled in an approved manner.

Headcut Severe channel erosion that progresses upstream.

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Highest previous use A sustainable use of the land which had the greatest economic and social value to the people of the area prior to the commencement of the mining operation.

Highwall The face of exposed overburden or coal in an open cut of a surface mine or entry to an underground mine.

Hydrologic connection A physical link between groundwater aquifers, surface water and groundwater, or surface waters.

Hydrologic properties The natural water quality to support use as a fishery but protected for agricultural and wildlife watering uses.

Hydrologic system The entire state of water movement in a given area. It is a function of the climate and includes the phenomena by which water first occurs as atmospheric water vapor, passes into a liquid or solid form, and falls as precipitation, moves thence along or into the ground surface, and returns to the atmosphere as vapor by means of evaporation and transpiration. With respect to alluvial valley floors, those conditions of surface and groundwater hydrology that make water of a suitable quality and quantity usefully available for subirrigation or flood irrigation agricultural activities. These conditions may include, but are not limited to, the erosional state of the stream, the surface water balance, the groundwater balance, the physical and chemical properties of the soils, water, and substrata, and topographic configuration.

Hydrology The science dealing with the occurrence, circulation, distribution, and properties of the waters of the earth and its atmosphere.

Important habitat Habitat which, in limited availability, supports or encourages a maximum diversity of wildlife species or fulfills one or more living requirements of a wildlife species. Examples of important habitat include, but are not limited to, wetlands, riparian areas, rimrocks, areas offering special shelter or protection, reproduction and nursery areas, and wintering areas.

Impoundment A closed basin, natural or man-made, which is dammed or excavated for the retention of water, slurry, or other liquid or semi-liquid material. A permanent impoundment is a structure that will remain after final bond release.

Intermittent stream A stream or part of a stream that is below the local water table for some part of the year, but is not a perennial stream.

Land use The specific uses or management-related activities, including surface coal mining operations, other than vegetation or cover of the land, which may be identified in combination when joint or seasonal uses occur. Changes of land uses or uses from a listed category shall be considered as a change to an alternative land use and is subject to approval by the Administrator of the LQD. Land used for mine facilities in support of the operations which are adjacent to or an integral part of these operations are also included. Support facilities include, but are not limited to, parking, storage, or shipping facilities. Categories of land which require change-of-use approval from the Administrator include cropland, pasture land, grazing land, forestry, residential, industrial commercial, recreational, fish and wildlife habitat, developed water resources, undeveloped land of no current use or land management, and treated grazing land.

Leasable minerals Minerals such as coal, oil shale, oil and gas, phosphate, potash, sodium, geothermal resources, and all other minerals that may be acquired under the Mineral Leasing Act of 1920, as amended.

Lease A document through which interests are transferred from one party to another, subject to certain rights, obligations, and considerations.

Lease (mineral) A contract between a landowner and another, granting the latter the right to search for and produce coal, gas, hydrocarbons, or other mineral substances upon payment of an agreed rental. Hydrocarbons are organic chemical compounds of hydrogen and carbon atoms which form the basis of all petroleum products.

Light-use road A limited road established and utilized for exploration, for occasional inspection of monitoring equipment, weather station, test plots, or other purposes necessary to comply with the WDEQ regulations.

Loadout A structure used for loading coal onto trucks, conveyor, or rail spur.

Locatable minerals Minerals that may be acquired under the Mining Law of 1872, as amended.

Longwall Mining System A mining system which utilizes a shearing device with two rotating drums for cutting coal, a self-propelled hydraulic roof support, and a conveyor to continuously mine coal.

Mercalli scale The scale by which earthquake intensity is measured.

Mine facilities Those structures and areas incidental to the operation of the mine, including mine offices, processing facilities, mineral stockpiles, storage facilities, shipping, loadout and repair facilities, and utility corridors.

Mitigation measures Actions which could be taken to lessen the adverse effects of proposed project development upon existing resources.

Monitoring The collection of environmental and hydrological data by either continuous or periodic sampling methods.

Monitoring well A well constructed or utilized to measure static water levels or to obtain liquid, solid, or gaseous analytical samples or other physical data that would be used for controlling the operations or to indicate potential circumstances that could affect the environment.

Mulch Plant residue or other suitable materials placed upon the soil surface to aid in soil stabilization and soil moisture conservation.

Off-road vehicle Any motorized vehicle capable of or designed for travel on or immediately over land, water, or other natural terrain.

Overburden Material of any nature that overlies a deposit of useful materials; waste earth and rock covering a coal or mineral deposit.

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Paleontology A science dealing with the life and past geological periods as known from fossil remains.

Perennial stream A stream or part of a stream that flows continuously during all of the calendar year as a result of groundwater discharge or surface runoff.

Permeability The characteristic of soil layers which allows for the penetration of water through pores or interstices to the underlying aquifers.

Permit area The area of land and water within the boundaries of the approved permit or permits during the entire life of the operation and includes all affected lands and waters.

Playa The sandy, salty, or mud-caked flat floor of a desert basin having interior drainage, usually occupied by a shallow lake during or after prolonged, heavy rains.

Population All the individuals belonging to a single plant or animal species occupying a particular area of space.

Potentiometric surface The surface that coincides with the static level of water in an aquifer. The surface is represented by the levels to which water from a given aquifer will rise under its full head.

Precipitation event A quantity of water resulting from drizzle, rain, snow, sleet, or hail in a limited period of time. It may be expressed in terms of recurrence, interval, and duration.

Probable hydrologic consequences The projected impacts or changes to the hydrologic regime caused by the proposed surface coal mining and reclamation operation, including the effects of adjacent mining operations.

Production Rate The quantity of coal mined in a given time period.

Public land Lands administered by the Bureau of Land Management; vacant, unappropriated, and unreserved lands which have never left federal ownership; also, lands in federal ownership which were obtained by the U.S. Government in exchange for public lands or for timber on public lands.

Public road Any thoroughfare open to the public which has been and is being used by the public for passage of vehicles, and is maintained by public funds.

Recharge The processes by which groundwater is absorbed into the zone of saturation.

Reclaimed Land surface which has been backfilled, graded, contoured, and revegetated in accordance with an approved reclamation plan.

Reference area A land unit which is representative, in terms of physiography, soils, vegetation, and land use history, of a plant community to be affected by mining activities as verified by a statistical comparison of absolute values of percent cover and total herbaceous productivity between affected area and reference area data and no mathematical climatic adjustment is made.

Riparian habitat (aquatic; streamside) Vegetation communities found in association with streams (both perennial and intermittent), lakes, ponds, and other open water. This unique habitat is crucial to the continued existence of fish species. Streamside vegetation maintains high water tables, stabilizes streambanks, creates quality fishery habitat, and maintains water quality. It is also essential to most terrestrial wildlife species.

Riparian habitat (terrestrial) Vegetation communities found in association with either open water or water close to the surface; includes such habitat as meadows, aspen stands, and/or other trees and shrubs. This unique habitat is crucial to the continued existence of the majority of terrestrial wildlife species. Many species are found nowhere else.

Riprap A quantity of broken stone used to stabilize slopes and embankments.

Road A surface right-of-way for purposes of travel by land vehicles including the roadbed, shoulders, parking areas, structures, and drainage features.

Rough backfilling Replacement of sufficient material in the pit or pits, including special disposal practices for toxic and acid-forming materials, special handling and placement of materials for stream reconstruction or alluvial valley floors, and compaction as required so as to render the affected area in a condition whereby the reclaimed land surface generally resembles the approved postmining contours.

Safety factor The ratio of the available shear strength to the developed shear stress on a potential surface of sliding determined by accepted engineering practice.

Saleable minerals Minerals such as sand, stone, gravel, clay, and scoria that may be acquired under the Materials Act of 1947, as amended, and which can be mined in commercially feasible quantities.

Saturation A measure of the extent to which pore space in the sand or rock is occupied by water.

Scoping process An early and public process for determining the nature, significance, and range of issues to be addressed related to a proposed action.

Sedimentation pond A sediment control structure designed, constructed, and maintained to slow down or impound precipitation runoff to reduce sediment concentrations in a point source discharge, including dams or excavated depressions. The term does not include straw dikes, riprap, check dams, mulches, collection ditches, toe ditches, vegetative buffers, gabions, contour furrows, and other traditional soil conservation techniques and non-point source runoff controls.

Shearer A machine used to cut coal from the highwall by moving the edge of a blade through it in a lateral, back-and-forth motion, thus removing the coal in symmetrical portions.

Soil/Overburden Mass Balance An accounting of the amount of soil/overburden to be removed and replaced during mining.

Soft rock surface mining Surface mining of materials deposited within or as sedimentary rock formations which include: coal, uranium, sand and gravel, jade, bentonite, hot springs deposits, placer mining, clay, gypsum, oil shale, and scoria.

Soil horizon Contrasting layers of soil material approximately parallel to the land surface and differing from adjacent layers in physical, chemical, and biological properties or characteristics. The horizons are defined as follows.

> **A Horizon** The uppermost mineral or organic layer, often referred to as the surface soil. It is part of the soil in which organic matter is most abundant and leaching of soluble or suspended particles is typically the greatest.
>
> **E Horizon** The layer commonly near the surface, below the A Horizon and above the B Horizon. An E Horizon is most commonly differentiated from an overlying A Horizon by lighter color, and generally, measurably less organic matter. The E Horizon is differentiated from the underlying B Horizon in the same sequum by color of higher value or lower chroma, by coarser texture, or by a combination of these properties.
>
> **B Horizon** The layer that typically is immediately beneath the E Horizon, often called the subsoil. This middle layer commonly contains more clay, iron, and aluminum than the A, E, or C Horizons.
>
> **C Horizon** The deepest layer of soil profile. It consists of loose material or weathered rock that is relatively unaffected by biological activity, and is often called the subsoil.

Soil survey A field and other investigation which results in a map showing the geographic distribution of different kinds of soils based on taxonomic characteristic and includes a report that describes, classifies, and interprets such soils for use in reclamation.

Species (candidate) An animal or plant which may be designated threatened or endangered in the near future. This status offers no legal protection under the ESA.

Species (endangered) An animal or plant whose prospects of survival and reproduction are in immediate jeopardy, and as is further defined by the ESA.

Species (sensitive) One of two groups of plants or animals: (A) those which would be appropriate for listing as threatened or endangered, but do not have sufficient data to be used in the listing process; these species need more study, or (B) those which are not being considered as candidates for the listing process, but are known to be rare, site-specific, endemic, or in potentially threatened land use areas (the BLM gives sensitive species the same consideration for protection as threatened or endangered species).

Species (threatened) Any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range, and is further defined by the ESA.

Species composition The number, kinds, amount, and quality of species.

Species diversity The number of species per unit area.

Spoil Overburden removed during the mining operation to expose the mineral and does not include the marketable mineral, subsoil, or topsoil.

Stabilize To control the movement of spoil, spoil piles, or areas of disturbed earth by modifying the geometry of the mass, adding control structures, or by otherwise modifying physical or chemical properties.

Steep slope Any slope of more than 20 degrees or such lesser slope as may be designated after consideration of soil, climate, and other characteristics of the area.

Stockpile A supply of material held for future use.

Subballast Crushed rock used for the construction of railroad grades.

Subirrigation With respect to alluvial valley floors, the supplying of water to plants from underneath, or from a semi-saturated or saturated subsurface zone where water is available for use by vegetation.

Subsidence The measurable lowering of a portion of the earth's surface or substrata.

Subsoil The B an C Horizons excluding consolidated bedrock material.

Surface coal mine An excavation made in the surface of the earth for the purpose of removing minable coal.

Surface water Water, either flowing or standing, on the surface of the earth.

Suspended solids Organic or inorganic material carried or held in suspension in water which is retained by a standard glass fiber filter in the procedure outlined by the EPA's regulations for waste water analysis (40 CFR 136).

Surficial rock unit Rock formation that occurs at the surface.

Topsoil The A and E Horizons or any combinations thereof.

Total suspended particulates All solid or semi-solid material found in the atmosphere (i.e., dust).

Toxic materials Earthen materials or refuse which, if acted upon by air, water, weather, or microbiological processes, are likely to produce chemical or physical conditions in soils or water that are detrimental to biota or would restrict the common uses of water.

Transmissivity A measure of the rate of groundwater movement through an aquifer.

Transportation corridor A corridor designated for the construction of a method of transportation (i.e., railroad, road, conveyor).

Travelway A transportation corridor or right-of-way designated for travel.

Underground coal mine A subterranean excavation made for the purpose of extracting minable coal.

Upland areas Those geomorphic features located outside the area of unconsolidated stream-laid deposits and may include isolated higher terraces, alluvial fans, pediment surfaces, landslide deposits, and surfaces covered with residuum, mud flows or debris flows, as well as highland areas underlain by bedrock and covered by residual weathered material or debris deposited by sheetwash, rillwash, or windblown material.

Visual Resource Management (VRM) The planning, designing, and implementation of management objectives for maintaining scenic value and visual quality on public lands. The five degrees of acceptable visual change within a characteristic landscape are as follows.

> **Class I** Preservation areas which provide for natural ecological changes only. This class includes primitive areas, some natural areas, some wild and scenic rivers, and other similar sites where landscape modification activities should be restricted.
>
> **Class II** Areas where there is a partial retention of the landscape character. This class includes areas where changes in any of the basic elements (form, line, color, or texture) caused by management activity should not be evident in the characteristic landscape.
>
> **Class III** Areas where there is partial retention of the landscape character. This class includes areas where changes in the basic elements (form, line, color, or texture) caused by a management activity may be evident in the characteristic landscape.
>
> **Class IV** Areas where there is a modification of the landscape character. This class includes areas where changes may subordinate the original composition and character of the landscape.
>
> **Class V** These areas require change in order to restore the landscape through rehabilitation or enhancement of the landscape character.

Vegetation type A recognizable group of species growing together due to similar requirements and tolerances.

Watershed A total area of land above a given point on a waterway that contributes runoff water to the flow at that point.

Water table The upper surface of a zone of saturation, where the body of groundwater is not confined by an overlying impermeable zone.

Wild horses All unbranded and unclaimed horses and their progeny that roam public lands, or that use these lands as all or part of their habitat after December 15, 1971.

Windfarm A windpower generating facility.

Windpower Electricity generated by wind movement through a turbine.

APPENDIX A:
ANIMAL SPECIES LIST

Animal Species Known to Occur or Potentially Occurring Within the CBCPA[1] or Possibly Affected by Depletions in the Platte River System[2]

Common Name	Scientific Name
Mammals[3]	
Masked shrew	*Sorex cinereus*
Pygmy shrew	*S. hoyi*
Dusky shrew	*S. monticolus*
Dwarf shrew	*S. nanus*
Water shrew	*S. palustris*
Merriam's shrew	*S. merriami*
Little brown myotis[4]	*Myotis lucifugus*
Fringed myotis	*M. thysanodes*
Long-legged myotis	*M. volans*
Small-footed myotis	*M. ciliolabrum*
Pallid bat	*Antrozous pallidus pallidus*
Townsend's pale big-eared bat	*Plecotus townsendii palescens*
Big brown bat	*Eptesicus fuscus*
Hoary bat[5]	*Lasiurus cinereus*
Mountain (Nuttall's) cottontail[4]	*Sylvilagus nuttallii*
Desert cottontail[4]	*S. audubonii*
Black-tailed jackrabbit	*Lepus californicus*
White-tailed jackrabbit[4]	*L. townsendii*
Yellow pine chipmunk	*Tamias amoenus*
Least chipmunk[4]	*T. minimus*
Uinta chipmunk	*T. umbrinus*
Yellow-bellied marmot[4]	*Marmota flaviventris*
Wyoming ground squirrel[4]	*Spermophilus elegans*
Thirteen-lined ground squirrel[4]	*S. tridecemlineatus*
Golden-mantled ground squirrel	*S. lateralis*
White-tailed prairie dog[4]	*Cynomys leucurus*
Eastern fox squirrel[4]	*Sciurus niger*
Red squirrel	*Tamiasciurus hudsonicus*
Northern pocket gopher[4]	*Thomomys talpoides*
Olive-backed pocket mouse	*Perognathus fasciatus*

Animal Species ... (Continued)

Common Name	Scientific Name
Silky pocket mouse	*P. flavus*
Ord's kangaroo rat[4]	*Dipodomys ordii*
Beaver[4, 5]	*Castor canadensis*
Western harvest mouse	*Reithrodontomys megalotis*
Deer mouse[4]	*Peromyscus maniculatus*
White-footed mouse	*P. leucopus*
Northern grasshopper mouse[4]	*Onychomys leucogaster*
Bushy-tailed woodrat[4]	*Neotoma cinerea*
Southern red-backed vole[5]	*Clethrionomys gapperi*
Heather vole	*Phenacomys intermedius*
Montane vole	*Microtus montanus*
Long-tailed vole	*M. longicaudus*
Prairie vole	*M. ochrogaster*
Sagebrush vole[4]	*Lemmiscus curtatus*
Muskrat[4]	*Ondatra zibethicus*
Western jumping mouse	*Zapus princeps*
Porcupine[4]	*Erethizon dorsatum*
Coyote[4]	*Canis latrans*
Red fox[4]	*Vulpes vulpes*
Swift fox[4]	*V. velox*
Gray fox[4]	*Urocyon cinereoargenteus*
Black bear[4]	*Ursus americanus*
Raccoon[4]	*Procyon lotor*
Ermine	*Mustela erminea*
Long-tailed weasel[4]	*M. frenata*
Black-footed ferret	*M. nigripes*
Mink[5]	*M. vison*
Badger[4]	*Taxidea taxus*
Western spotted skunk	*Spilogale gracilis*
Striped skunk[4]	*Mephitis mephitis*
Mountain lion[4]	*Felis concolor*

Animal Species ... (Continued)

Common Name	Scientific Name
Bobcat[4]	*F. rufus*
Elk[4]	*Cervus elaphus*
Mule deer[4]	*Odocoileus hemionus*
White-tailed deer[4]	*O. virginianus*
Moose[4, 5]	*Alces alces*
Pronghorn[4]	*Antilocapra americana*
Birds[4]	
Common loon[4]	*Gavia immer*
Pied-billed grebe[4]	*Podilymbus podiceps*
Horned grebe	*Podiceps auritus*
Eared grebe[4]	*P. nigricollis*
Western grebe[4]	*Aechmophorus occidentalis*
American white pelican[4]	*Pelecanus erythrorhynchos*
Double-crested cormorant[4]	*Phalacrocorax auritus*
American bittern	*Botaurus lentiginosus*
Great blue heron[4]	*Ardea herodias*
Snowy egret	*Egretta thula*
Cattle egret	*Bubulcus ibis*
Green heron	*Butorides virescens*
Black-crowned night-heron	*Nycticorax nycticorax*
White-faced ibis[4]	*Plegadis chihi*
Tundra swan[4]	*Cygnus columbianus*
Snow goose[4]	*Chen caerulescens*
Canada goose[4]	*Branta canadensis*
Wood duck	*Aix sponsa*
Green-winged teal[4]	*Anas crecca*
Mallard[4]	*A. platyrhynchos*
Northern pintail[4]	*A. acuta*
Blue-winged teal[4]	*A. discors*
Cinnamon teal[4]	*A. cyanoptera*
Northern shoveler[4]	*A. clypeata*

Animal Species ... (Continued)

Common Name	Scientific Name
Gadwall[4]	*A. strepera*
American wigeon[4]	*A. americana*
Canvasback[4]	*Aythya valisineria*
Redhead[4]	*A. americana*
Ring-necked duck[4]	*A. collaris*
Lesser scaup[4]	*A. affinis*
Common goldeneye[4]	*Bucephala clangula*
Bufflehead[4]	*B. albeola*
Common merganser[4]	*Mergus merganser*
Red-breasted merganser	*M. serrator*
Ruddy duck[4]	*Oxyura jamaicensis*
Turkey vulture[4]	*Cathartes aura*
Osprey[4]	*Pandion haliaetus*
Bald eagle[4]	*Haliaeetus leucocephalus*
Northern harrier[4]	*Circus cyaneus*
Sharp-shinned hawk[4]	*Accipiter striatus*
Cooper's hawk	*A. cooperii*
Northern goshawk[4]	*A. gentilis*
Broad-winged hawk[4]	*Buteo platypterus*
Swainson's hawk[4]	*B. swainsoni*
Red-tailed hawk[4]	*B. jamaicensis*
Ferruginous hawk[4]	*B. regalis*
Rough-legged hawk[4]	*B. lagopus*
Golden eagle[4]	*Aquila chrysaetos*
American kestrel[4]	*Falco sparverius*
Merlin[4]	*F. columbarius*
Peregrine falcon[4]	*F. peregrinus*
Prairie falcon[4]	*F. mexicanus*
Blue grouse[4, 5]	*Dendragapus obscurus*
Sage grouse[4]	*Centrocercus urophasianus*
Sharp-tailed grouse[4]	*Tympanuchus phasianellus*

Animal Species ... (Continued)

Common Name	Scientific Name
Wild turkey[4]	*Meleagris gallopavo*
Virginia rail[4]	*Rallus limicola*
Sora[4]	*Porzana carolina*
American coot[4]	*Fulica americana*
Sandhill crane[4]	*Grus canadensis*
Black-bellied plover	*Pluvialis squatarola*
Western snowy plover	*Charadrius alexandrinus nivosus*
Semipalmated plover[4]	*C. semipalmatus*
Killdeer[4]	*C. vociferus*
Mountain plover[4]	*C. montanus*
Black-necked stilt	*Himantopus mexicanus*
American avocet[4]	*Recurvirostra americana*
Greater yellowlegs[4]	*Tringa melanoleuca*
Lesser yellowlegs	*T. flavipes*
Solitary sandpiper	*T. solitaria*
Willet	*Catoptrophorus semipalmatus*
Spotted sandpiper[4]	*Actitus macularia*
Upland sandpiper[4]	*Bartramia longicauda*
Long-billed curlew[4]	*Numenius americanus*
Marbled godwit	*Limosa fedoa*
Sanderling	*Calidris alba*
Semipalmated sandpiper	*C. pusilla*
Western sandpiper	*C. mauri*
Least sandpiper	*C. minutilla*
Baird's sandpiper[4]	*C. bairdii*
Pectoral sandpiper	*C. melanotos*
Stilt sandpiper	*C. himantopus*
Long-billed dowitcher[4]	*Limnodromus scolopaceus*
Common snipe[4]	*Gallinago gallinago*
Wilson's phalarope[4]	*Phalaropus tricolor*
Red-necked phalarope	*P. lobatus*

Animal Species ... (Continued)

Common Name	Scientific Name
Franklin's gull[4]	*Larus pipixcan*
Bonaparte's gull	*L. philadelphia*
Ring-billed gull	*L. delawarensis*
California gull[4]	*L. californicus*
Herring gull	*L. argentatus*
Caspian tern	*Sterna caspia*
Forster's tern	*S. forsteri*
Black tern	*Chlidonias niger*
Rock dove[4]	*Columba livia*
Mourning dove[4]	*Zenaida macroura*
Black-billed cuckoo	*Coccyzus erythropthalmus*
Barn owl	*Tyto alba*
Great horned owl[4]	*Bubo virginianus*
Western burrowing owl[4]	*Athene cunicularia hypugea*
Long-eared owl	*Asio otus*
Short-eared owl[4]	*A. flammeus*
Northern saw-whet owl[4, 5]	*Aegolius acadicus*
Common nighthawk[4]	*Chordeiles minor*
Common poorwill	*Phalaenoptilus nuttallii*
White-throated swift	*Aeronautes saxatalis*
Broad-tailed hummingbird[4]	*Selasphorus platycercus*
Rufous hummingbird	*S. rufus*
Belted kingfisher[4, 5]	*Ceryle alcyon*
Lewis' woodpecker[5]	*Melanerpes lewis*
Red-headed woodpecker[4, 5]	*Melanerpes erythrocephalus*
Red-naped sapsucker[5]	*Sphyrapicus nuchalis*
Williamson's sapsucker[5]	*S. thyroideus*
Downy woodpecker[4]	*Picoides pubescens*
Hairy woodpecker[4]	*P. villosus*
Northern flicker[4]	*Colaptes auratus*
Olive-sided flycatcher[4, 5]	*Contopus borealis*

Animal Species ... (Continued)

Common Name	Scientific Name
Western wood-pewee[4, 5]	*C. sordidulus*
Willow flycatcher[4]	*Empidonax traillii*
Least flycatcher[4]	*E. minimus*
Hammond's flycatcher[4]	*E. hammondii*
Dusky flycatcher[4]	*E. oberholseri*
Cordilleran flycatcher	*E. occidentalis*
Say's phoebe[4]	*Sayornis saya*
Ash-throated flycatcher	*Myiarchus cinerascens*
Western kingbird[4]	*Tyrannus verticalis*
Eastern kingbird[4]	*T. tyrannus*
Horned lark[4]	*Eremophila alpestris*
Purple martin[4]	*Progne subis*
Tree swallow[4]	*Tachycineta bicolor*
Violet-green swallow[4]	*T. thalassina*
Northern rough-winged swallow[4]	*Stelgidopteryx serripennis*
Bank swallow[4]	*Riparia riparia*
Cliff swallow[4]	*Hirundo pyrrhonota*
Barn swallow[4]	*H. rustica*
Gray jay[4]	*Perisoreus canadensis*
Steller's jay	*Cyanocitta stelleri*
Blue jay	*C. cristata*
Scrub jay	*Aphelocoma coerulescens*
Pinyon jay[4]	*Gymnorhinus cyanocephalus*
Clark's nutcracker[4]	*Nucifraga columbiana*
Black-billed magpie[4]	*Pica pica*
American crow[4]	*Corvus brachyrhynchos*
Common raven[4]	*C. corax*
Black-capped chickadee[4]	*Parus atricapillus*
Mountain chickadee[4]	*P. gambeli*
Plain titmouse[5]	*P. inornatus*
Bushtit[5]	*Psaltriparus minimus*

Animal Species ... (Continued)

Common Name	Scientific Name
Red-breasted nuthatch[4,5]	*Sitta canadensis*
White-breasted nuthatch[4,5]	*S. carolinensis*
Pygmy nuthatch[5]	*S. pygmaea*
Brown creeper[5]	*Certhia americana*
Rock wren[4]	*Salpinctes obsoletus*
Canyon wren	*Catherpes mexicanus*
Bewick's wren	*Thryomanes bewickii*
House wren[4]	*Troglodytes aedon*
Marsh wren	*Cistothorus palustris*
American dipper[4,5]	*Cinclus mexicanus*
Golden-crowned kinglet[4,5]	*Regulus satrapa*
Ruby-crowned kinglet[4,5]	*R. calendula*
Blue-gray gnatcatcher[5]	*Polioptila caerulea*
Eastern bluebird	*Sialia sialis*
Western bluebird	*S. mexicana*
Mountain bluebird[4]	*S. currucoides*
Townsend's solitaire[4]	*Myadestes townsendi*
Veery[5]	*Catharus fuscescens*
Swainson's thrush[5]	*C. ustulatus*
Hermit thrush[4,5]	*C. guttatus*
American robin[4]	*Turdus migratorius*
Gray catbird[4]	*Dumetella carolinensis*
Northern mockingbird	*Mimus polyglottos*
Sage thrasher[4]	*Oreoscoptes montanus*
Brown thrasher	*Toxostoma rufum*
American pipit[4]	*Anthus rubescens*
Bohemian waxwing	*Bombycilla garrulus*
Cedar waxwing[4]	*B. cedrorum*
Northern shrike[4]	*Lanius excubitor*
Loggerhead shrike[4]	*L. ludovicianus*
European starling[4]	*Sturnus vulgaris*

Animal Species ... (Continued)

Common Name	**Scientific Name**
Solitary vireo[5]	*Vireo solitarius*
Warbling vireo[5]	*V. gilvus*
Red-eyed vireo[4, 5]	*V. olivaceus*
Tennessee warbler[5]	*Vermivora peregrina*
Orange-crowned warbler[4]	*V. celata*
Virginia's warbler[4]	*V. virginiae*
Yellow warbler[4]	*Dendroica petechia*
Yellow-rumped warbler[4]	*D. coronata*
Townsend's warbler[4]	*D. townsendi*
Blackpoll warbler[5]	*D. striata*
Black-and-white warbler[5]	*Mniotilta varia*
American redstart[5]	*Setophaga ruticilla*
Ovenbird[5]	*Seiurus aurocapillus*
MacGillivray's warbler[4]	*Oporornis tolmiei*
Common yellowthroat	*Geothlypis trichas*
Wilson's warbler[4]	*Wilsonia pusilla*
Yellow-breasted chat[5]	*Icteria virens*
Western tanager[4, 5]	*Piranga ludoviciana*
Rose-breasted grosbeak[5]	*Pheucticus ludovicianus*
Black-headed grosbeak[4, 5]	*P. melanocephalus*
Blue grosbeak[4]	*Guiraca caerulea*
Lazuli bunting[4]	*Passerina amoena*
Indigo bunting	*P. cyanea*
Dickcissel	*Spiza americana*
Green-tailed towhee[4]	*Pipilo chlorurus*
Rufous-sided towhee[4]	*P. erythrophthalmus*
American tree sparrow[4]	*Spizella arborea*
Chipping sparrow[4]	*S. passerina*
Clay-colored sparrow[4]	*S. pallida*
Brewer's sparrow[4]	*S. breweri*
Vesper sparrow[4]	*Pooecetes gramineus*

Animal Species ... (Continued)

Common Name	Scientific Name
Lark sparrow[4]	*Chondestes grammacus*
Black-throated sparrow	*Amphispiza bilineata*
Sage sparrow[4]	*A. belli*
Lark bunting[4]	*Calamospiza melanocorys*
Savannah sparrow[4]	*Passerculus sandwichensis*
Baird's sparrow	*Ammodramus bairdii*
Grasshopper sparrow	*A. savannarum*
Fox sparrow	*Passerella iliaca*
Song sparrow[4]	*Melospiza melodia*
Lincoln's sparrow	*M. lincolnii*
White-throated sparrow[4]	*Zonotrichia albicollis*
White-crowned sparrow[4]	*Z. leucophrys*
Dark-eyed junco[4]	*Junco hyemalis*
McCown's longspur[4]	*Calcarius mccownii*
Lapland longspur	*C. lapponicus*
Chestnut-collared longspur	*C. ornatus*
Snow bunting	*Plectrophenax nivalis*
Bobolink[4, 5]	*Dolichonyx oryzivorus*
Red-winged blackbird[4]	*Agelaius phoeniceus*
Western meadowlark[4]	*Sturnella neglecta*
Yellow-headed blackbird[4]	*Xanthocephalus xanthocephalus*
Rusty blackbird	*Euphagus carolinus*
Brewer's blackbird[4]	*E. cyanocephalus*
Common grackle[4]	*Quiscalus quiscula*
Brown-headed cowbird[4]	*Molothrus ater*
Orchard oriole[4, 5]	*Icterus spurius*
Northern oriole[4, 5]	*I. galbula*
Gray-crowned rosy finch[4]	*Leucosticte tephrocotis*
Black rosy finch[4]	*L. atrata*
Brown-capped rosy finch	*L. australis*
Pine grosbeak[4, 5]	*Pinicola enucleator*

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Animal Species ... (Continued)

Common Name	Scientific Name
Purple finch[4]	*Carpodacus purpureus*
Cassin's finch[4]	*C. cassinii*
House finch[4]	*C. mexicanus*
Red crossbill[5]	*Loxia curvirostra*
Common redpoll	*Carduelis flammea*
Pine siskin[4]	*C. pinus*
Lesser goldfinch	*C. psaltria*
American goldfinch[4]	*C. tristis*
Evening grosbeak[4, 5]	*Coccothraustes vespertinus*
House sparrow[4]	*Passer domesticus*
Amphibians and Reptiles[7]	
Tiger salamander[4]	*Ambystoma tigrinum*
Leopard frog[4]	*Rana pipiens*
Chorus frog	*Pseudacris triseriata*
Northern sagebrush lizard	*Sceloporus graciosus graciousus*
Eastern short-horned lizard[8]	*Phrynosoma douglassi brevirostre*
Prairie rattlesnake	*Crotalus viridus*
Western terrestrial garter snake	*Thamnophis elegans*
Fish[5]	
Common carp[4, 5]	*Cyprinus carpio*
Silver shiner[5]	*Notropis photogenis*
Creek chub[5]	*Semotilus atromaculatus*
Longnose sucker[5]	*Catostomus catostomus*
White sucker[5]	*C. commersoni*
Rainbow trout[4, 5]	*Oncorynchus mykiss*
Brown trout[4, 5]	*Salmo trutta*
Brook trout[4, 5]	*Salvelinus fontinalis*
Johnny darter[5]	*Etheostoma nigrum*
Walleye[5]	*Stizostedion vitreum*

Animal Species ... (Continued)

Common Name	Scientific Name
Animal Species Possibly Affected by Depletions in the Platte River System	
Whooping crane	*Grus americana*
Interior least tern	*Sterna antillarum*
Piping plover	*Charadrius melodus*
Eskimo curlew	*Numenius borealis*
Pallid sturgeon	*Scaphirhynchus albus*
American burying beetle	*Nicrophorus americanus*

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[1] Based on range, habitat characteristics, and actual field observations.

[2] Personal communication, March 1998, with Dave Felley, USFWS.

[3] Adapted from Clark and Stromberg (1987), Mariah (1995), Oakleaf et al. (1996), and Orpet (1997).

[4] Species documented during field surveys within or immediately adjacent to the CBCPA (Mariah 1995; Orpet 1997; WGFD 1997b).

[5] Most likely to occur along the Medicine Bow River. If Arch removes the Medicine Bow River from the permit area as proposed, these species would be unlikely to occur within the CBCPA.

[6] Adapted from Scott (1987), Russell (1990), Mariah (1995), Luce et al. (1997), and Orpet (1997). Some species likely would occur only as flythroughs during migration seasons.

[7] Adapted from Stebbins (1966), Smith and Brodie (1982), Baxter and Stone (1985), Mariah (1995), and Orpet (1997).

[8] Adapted from Baxter and Simon (1970), Oberholtzer (1985), and American Fisheries Society (1991).

APPENDIX B:
PLANT SPECIES LIST

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Plant Species Recorded in CBCPA and 2-mi Buffer in 1997
(Intermountain Resources, Inc. 1997)

Scientific Name	Common Name
Grasses	
Agropyron cristatum	Crested wheatgrass
Agropyron dasystachyum (Elymus lanceolatus spp. lanceolatus)	Thickspike wheatgrass
Agropyron elongatum (Elymus elongatuse)	Tall wheatgrass
Agropyron intermedium (Elymus hispidus)	Intermediate wheatgrass
Agropyron riparium (Elymus lanceolatus spp. riparius)	Streambank wheatgrass
Agropyron smithii (Elymus smithii)	Western wheatgrass
Agropyron spicatum (Elymus spicatum)	Bluebunch wheatgrass
Agrostis stolonifera	Carpet bent
Agropyron trachycaulum (Elymus trachycaulus)	Slender wheatgrass
Alopecurus arundinaceus	Creeping foxtail
Aristida fendleriana	Fendler threeawn
Beckmannia syzigachne	American sloughgrass
Bouteloua gracilis	Blue grama
Bromus inermis	Smooth brome
Calamogrostis montanensis	Plains reedgrass
Distichlis stricta	Inland saltgrass
Elymus cinereus	Basin wildrye
Festuca idahoensis	Idaho fescue
Hordeum jubatum	Foxtail barley
Koeleria macrantha	Prairie junegrass
Melica spectablis	Showy melic
Muhlenbergia asperifolia	Alkali muhly
Oryzopsis contracta	Contracted Indian ricegrass
Oryzopsis hymenoides	Indian ricegrass
Phalaris arundinacea	Reed canarygrass
Phleum pratense	Common timothy
Poa ampla	Big bluegrass
Poa canbyi	Canby bluegrass
Poa fendleriana	Mutton bluegrass
Poa juncifolia	Alkali bluegrass

Plant Species ... (Continued)

Scientific Name	Common Name
Poa pratensis	Kentucky bluegrass
Poa secunda	Sandberg bluegrass
Puccinellia nuttalliana	Alkaligrass
Sitanion hystrix	Bottlebrush squirreltail
Sporobolus airoides	Alkali sacaton
Stipa comata	Needle-and-thread
Stipa viridula	Green needlegrass
Grass-Like	
Carex filifolia	Threadleaf sedge
Carex lanuginosa	Woolly sedge
Carex nebraskensis	Nebraska sedge
Carex praegracilis	Field clustered sedge
Carex stenophylla	Needleleaf sedge
Eleocharis acicularis	Slender spikebush
Eleocharis palustris	Longstem spikerush
Equisetum laevigatum	Smooth horsetail
Juncus balticus	Baltic rush
Juncus confusus	Colorado rush
Scirpus acutus	Tule bulrush
Scirpus maritimus	Alkali bulrush
Scirpus pungens	Bulrush
Triglochin maritimum	Seaside arrowgrass
Typha latifolia	Cattail
Perennial Forbs	
Achilea millefolium	Western yarrow
Asclepias speciosa	Showy milkweed
Agoseris glauca	Pale agoseris
Allium textile	Prairie onion
Ambrosia tomentosa	Skeletonleaf bursage
Antennaria dimorpha	Low pussytoes

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Plant Species ... (Continued)

Scientific Name	Common Name
Antennaria microphylla	Pussytoes
Antennaria rosea	Rose pussytoes
Arenaria congesta	Ballhead sandwort
Arnica fulgens	Orange arnica
Arenaria spp.	Sandwort
Arenaria hookeri	Hooker sandwort
Arabis holboellii	Rockcress
Aster ascendens	Longleaf aster
Astragalus bisulcatus	Twogrooved milkvetch
Astragalus drummondii	Drummond milkvetch
Astragalus pectinatus	Tineleaved milkvetch
Astragalus simplicifolius	Bun milkvetch
Aster falcatus	Whiteprairie aster
Astragalus missouriensis	Missouri milkvetch
Astragalus purshii	Pursh milkvetch
Aster spp.	Aster
Astragalus spp.	Milkvetch
Astragalus spatulatus	Spoonleaf milkvetch
Balsamorhiza sagittata	Arrowleaf balsamroot
Besseya wyomingensis	Kittentails
Cardaria spp.	Whitetop
Cardaria pubescens	Hairy whitetop
Castilleja chromosa	Desert paintbrush
Castilleja flava	Yellow paintbrush
Castilleja linariaefolia	Indian paintbrush
Cerastium arvense	Starry cerastium
Chaenactis douglasii	False yarrow
Cirsium arvense	Canada thistle
Cirsium canescens	Platte thistle
Cirsium vulgare	Bull thistle
Cirsium undulatum	Wavyleaf thistle

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Plant Species ... (Continued)

Scientific Name	Common Name
Convolvulus arvensis	Field bindweed
Comandra umbellata	Pale bastard toadflax
Crepis modocensis	Yellowstone hawksbeard
Crepis acuminata	Hawksbeard
Cryptantha bradburiana	Minerscandle crytpantha
Cryptantha celosioides	Northern cryptantha
Cryptantha flava	Yellow cryptantha
Cymopterus acaulis	Stemless springparsley
Cynoglossum officinale	Common houndstongue
Delphinium bicolor	Little larkspur
Erysimum asperum	Plains wallflower
Erigeron compositus	Fernleaf fleabane
Erigeron ochroleucus	Fleabane
Eriogonum ovalifolium	Cushion wildbuckwheat
Eriogonum umbellatum	Sulfur wildbuckwheat
Gaura coccinea	Scarlet gaura
Glycyrrhiza lepidota	American licorice
Grindelia squarrosa	Curlycup gumweed
Haplopappus acaulis	Stemless goldenweed
Haplopappus multicaulis	Stemmy goldenweed
Haplopappus nuttallii	Goldenweed
Haplopappus spinulosus	Ironplant goldenweed
Heterotheca villosa	Hairy goldenaster
Hymenoxys acaulis	Stemless hymenoxys
Hymenopappus polycephalus	Hymenopappus
Ipomopsis congesta	Ipomopsis
Ipomopsis spicata	Spike ipomopsis
Iris missouriensis	Rockymountain iris
Iva axillaris	Povertyweed
Lactuca serriola	Prickly lettuce
Leuocrinum montanum	Common starlily

Plant Species ... (Continued)

Scientific Name	Common Name
Lewisia rediviva	Bitterroot lewisia
Linaria vulgaris	Toadflax
Lithophragma glabrum	Woodland star
Lithospermum incisum	Narrowleaf gromwell
Linum lewisii	Lewis flax
Lithospermum ruderale	Wayside gromwell
Lomatium foeniculaceum	Hairyseed lomatium
Lesquerella ludoviciana	Foothill bladderpod
Lesquerella spp.	Bladderpod
Lupinus argenteus	Silvery lupine
Lupinus sericeus	Silky lupine
Lygodesmia juncea	Rush skeletonplant
Machaeranthera canescens	Spiney aster
Malva spp.	Mallow
Melilotus officinalis	Yellow sweetclover
Mentha arvensis	Field mint
Mertensia spp.	Bluebells
Mertensia brevistyla	Bluebell
Musineon divaricatum	Leafy musineon
Musineon tenuifolium	Narrow-leaved musineon
Oenothera caespitosa	Tufted eveningprimrose
Orobanche fasciculata	Purple broomrape
Oxytropis lambertii	Lambert loco
Oxytropis sericea	Silky loco
Penstemon albidus	White penstemon
Penstemon angustifolius	Narrowleaf penstemon
Penstemon eriantherus	Fuzzytongue penstemon
Perideridia gairdneri	Yampa
Penstemon spp.	Penstemon
Phacelia hastata	Silverleaf phacelia
Phlox hoodii	Hoods phlox

Plant Species ... (Continued)

Scientific Name	**Common Name**
Phlox longifolia	Longleaf phlox
Physaria acutifolia	Twinpod
Plantago major	Plantain
Potentilla spp.	Cinquefoil
Ratibida columnifera	Upright prairieconeflower
Ranunculus glaberrimus	Sagebrush buttercup
Ranunculus cymbalaria	Shore buttercup
Rorippa sinuata	Spreadingyellow watercress
Rumex crispus	Curly dock
Rumex salicifolius	Willowleaf dock
Rumex venosus	Veiny dock
Rumex spp.	Dock
Senecio canus	Woolly groundsel
Senecio integerrimus	Lambstongue groundsel
Sedum lanceolatum	Stonecrop
Schoenocrambe linifolia	Flaxleaf mustard
Solidago missouriensis	Missouri goldenrod
Sphaeralcea coccinea	Scarlet globemallow
Sphaeromeria capitata	False sagebrush
Suaeda nigra	Sea blite
Taraxacum laevigatum	Smooth dandelion
Taraxacum officinale	Common dandelion
Thermopsis rhombifolia	Prairie thermopsis
Townsendia incana	Townsendia
Tragopogon dubius	Yellow salsify
Trifolium gymnocarpon	Hollyleaf clover
Verbena bracteata	Sand verbena
Vicia Americana	American vetch
Viola nuttallii	Yellow prairie violet
Xylorhiza glabriuscula	Woody aster
Zigadenus venenosus	Meadow deathcamas

Plant Species ... (Continued)

Scientific Name	Common Name
Subshrubs	
Artemisia frigida	Fringed sagewort
Artemisia ludoviciana	Louisiana sagewort
Artemisia pedatifida	Birdsfoot sagewort
Atriplex gardneri	Gardner saltbush
Ceratoides lanata	Common winterfat
Eriogonum brevicaule	Shortstem wildbuckwheat
Eriogonum pauciflorum	Wildbuckwheat
Gutierrezia sarothrae	Broom snakeweed
Leptodactylon pungens	Pricklygilia
Mahonia repens	Oregon grape
Yucca glauca	Small soapweed
Shrubs	
Atriplex canescens	Fourwing saltbush
Amelanchier alnifolia	Serviceberry
Artemisia cana	Silver sagebrush
Artemisia tridentata	Big sagebrush
Artemisia tripartita	Threetip sagebrush
Atriplex confertifolia	Shadscale saltbush
Chrysothamnus nauseosus	Rubber rabbitbrush
Chrysothamnus viscidiflorus	Douglas rabbitbrush
Grayia spinosa	Spiny hopsage
Prunus virginiana	Chokecherry
Purshia tridentata	Antelope bitterbrush
Rhus trilobata	Skunkbush sumac
Ribes spp.	Currant
Rosa woodsii	Woods rose
Salix spp.	Willow
Sarcobatus vermiculatus	Black greasewood
Symphoricarpos occidentalis	Snowberry
Symphoricarpos oreophilus	Mountain snowberry

Plant Species ... (Continued)

Scientific Name	Common Name
Tetradymia canescens	Gray horsebrush
Tetradymia spinosa	Cottonthorn horsebrush
Succulents	
Coryphantha vivipara	Purple mamillaria
Opuntia polyacantha	Plains pricklypear
Annual Grasses	
Bromus japonicus	Japanese brome
Bromus tectorum	Cheatgrass brome
Festuca octoflora	Sixweeksgrass
Annual Forbs	
Alyssum alyssoides	Pale alyssum
Alyssum desertorum	Desert alyssum
Amaranthus blitoides	Prostrate pigweed
Argemone polyanthemos	Annual pricklepoppy
Atriplex spp.	Saltbush
Atriplex argentea	Tumbling saltbush
Atriplex suckleyi	Scurfless saltbush
Capsella bursa-pastoris	Common shepherdspurse
Camelina microcarpa	Littleseed falseflax
Centaurea diffusa	Knapweed
Chenopodium spp.	Goosefoot
Chorispora tenella	Little blue mustard
Chenopodium album	Goosefoot
Chenopodium fremontii	Fremont goosefoot
Cleome serrulata	Rockymountain beeplant
Collomia linearis	Narrowleaved collomia
Cordylanthus ramosus	Birdbeak
Descurainia pinnata	Pinnate tansymustard
Descurainia sophia	Flixweed tansymustard

Plant Species ... (Continued)

Scientific Name	Common Name
Gayophytum diffusum	Groundsmoke
Halogeton glomeratus	Halogeton
Helianthus annuus	Common sunflower
Kochia scoparia	Fireweed summercypress
Lappula redowskii	Bluebur stickseed
Lepidium densiflorum	Prairie pepperweed
Lepidium perfoliatum	Clasping pepperweed
Lupinus pusillus	Low lupine
Monolepis nuttalliana	Nuttall monolepis
Navarretia intertexta	Navarretia
Plantago patagonica	Wooly plantain
Plagiobothrys scouleri	Scouler popcornflower
Polygonum aviculare	Prostrate knotweed
Ranunculus testicularis	Testiculate buttercup
Salsola kali	Russian thistle
Salicornia rubra	Saltwort
Sisymbrium altissimum	Tumbling hedgemustard
Solanum rostratum	Buffalobur nightshade
Thlaspi arvensis	Field pennycress
Xanthium strumarium	Cocklebur
Xanthoparmelia	
Xanthoparmelia chlorochroa	Lichen
Trees	
Eleagnus angustifolia	Russian olive
Juniperus scopulorum	Rocky Mountain juniper
Pinus ponderosa	Ponderosa pine
Populus angustifolia	Narrowleaf cottonwood

APPENDIX C:
TOPOGRAPHIC ANALYSIS FOR VISUAL IMPACTS

TOPOGRAPHIC ANALYSIS FOR VISUAL IMPACTS

Visual impacts were not identified as a critical issue for the EIS, so creation of visual simulations was not warranted, but to address scoping comments, a topographic analysis was performed to determine the mine's visibility from I-80 and Highway 72. Part of the visual impacts analysis included a determination of how well topography would screen features of the mine from I-80 and Highway 72, which would be the most frequently traveled roads in the mine vicinity.

The analysis was performed using USGS 7.5' topographic maps. Sixteen cross sections were established (Figure C.1), and the topography between the endpoints of each cross section was plotted by hand and then scaled using AutoCAD (Figures C.2-C.5). One endpoint for each cross section was located along the highways, County Road 402, or Highway 30/287, the other end was located within the proposed spoil area for the Proposed Action. The height of the spoil piles was plotted 100 ft above the highest natural topographic feature in the spoil area, and the top of the dragline was plotted 100 ft above the top of the spoil pile. Thus, the topographic analysis assumed that the mine would exceed the local topography by 200 ft. A straight line was drawn between the point on the highway/road to the top of the spoil piles and to the top of the dragline. Anywhere the cross section intersects the line is considered a topographic screen where a viewer would not be able to see the mine.

The mine would be visible from point D, which is located on I-80 (looking in the direction of points A or B) and from point H, which is located on Highway 72 (looking in the direction of point G). All other cross sections along these highways show that the rolling hills between the highways and the mines are high enough to screen the top of the dragline from view.

The same analysis was completed along County Road 402 using points located near Halfway Hill, and it shows that the mine would not be visible from the vicinity of Halfway Hill (cross sections P-Q and P-R) nor from the rest area located near Exit 260 on I-80 (cross sections N-M, N-O, and N-U). Along County Road 402, the mines would be visible for approximately 4 mi from point V through point W.

Two cross sections (P-S and P-T) were completed from Highway 30/287 and show that there are no topographic screens between the highway and the mine site. However, the mines would be approximately 9 mi from Highway 30/287 would not be visible or only barely visible.

Computer simulations would produce a more detailed assessment of the extent of the topographic screen but is not warranted given the low level of concern for visual effects. As described in Section 4.6, some visual effects would be significant, but motorists on I-80 and Highway 72 would have only short-lived views (0.5-1.0 minute) of the mine.

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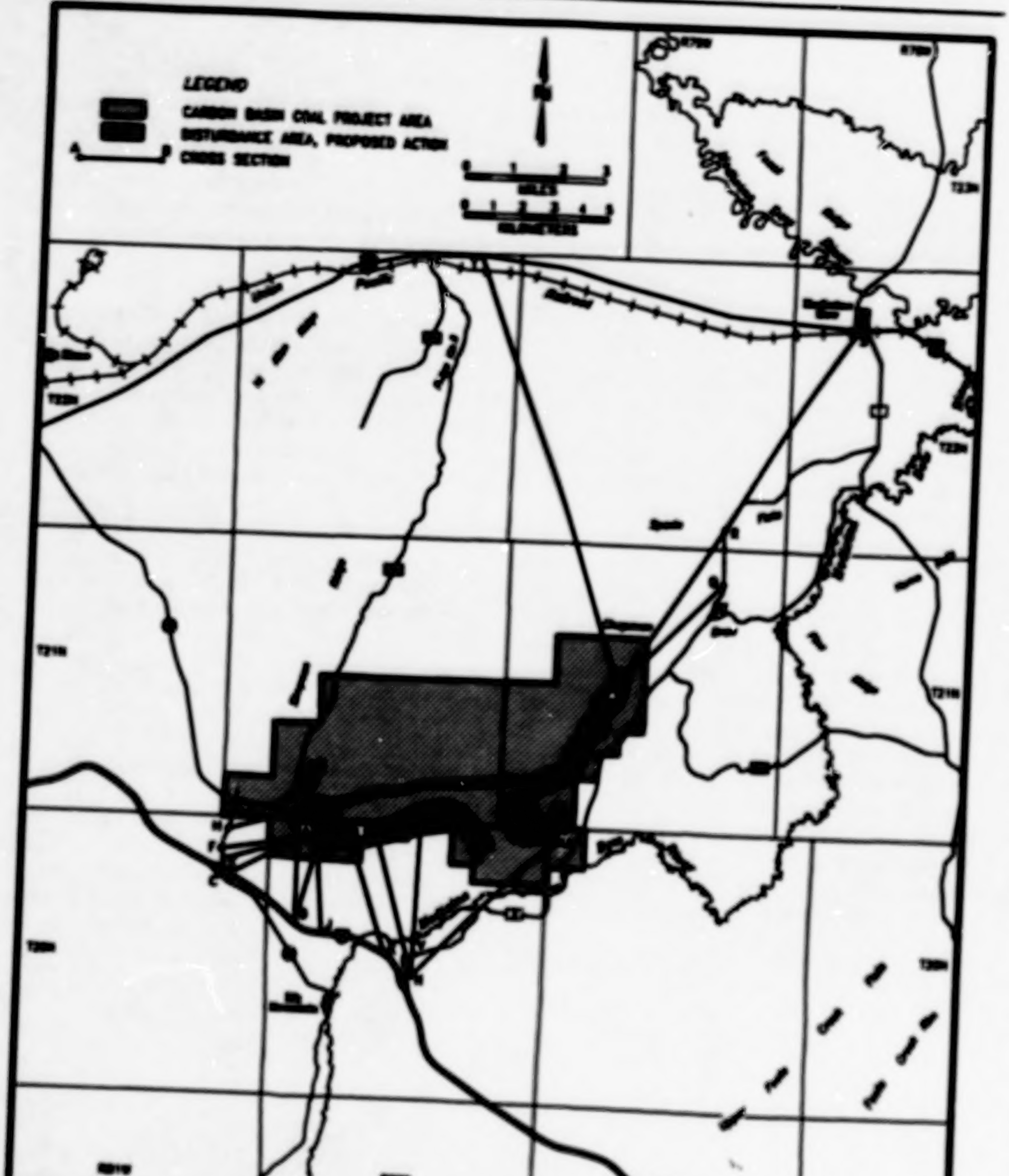
LEGEND
CARBON BASIN COAL PROJECT AREA
DISTURBANCE AREA, PROPOSED ACTION
CROSS SECTION
A
B
MILES
KILOMETERS
T22N
T21N
T20N
R81W
R80W
R79W

Figure C.1 Topographic Cross Section Locations for Visual Cross Sections.

369

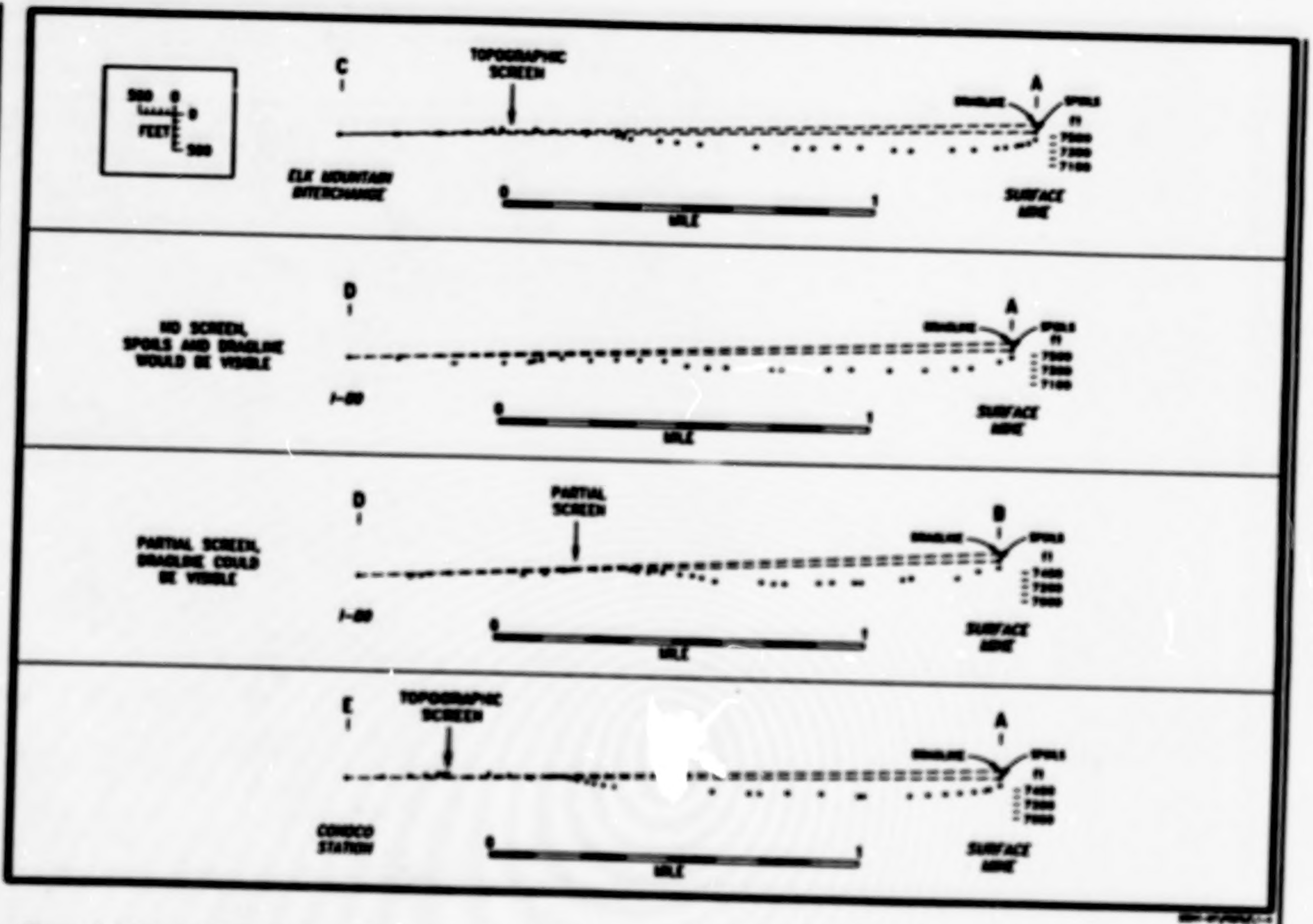

Figure C.2 Cross Sections of Topography Between I-80 or Highway 72 and the Mine.

370

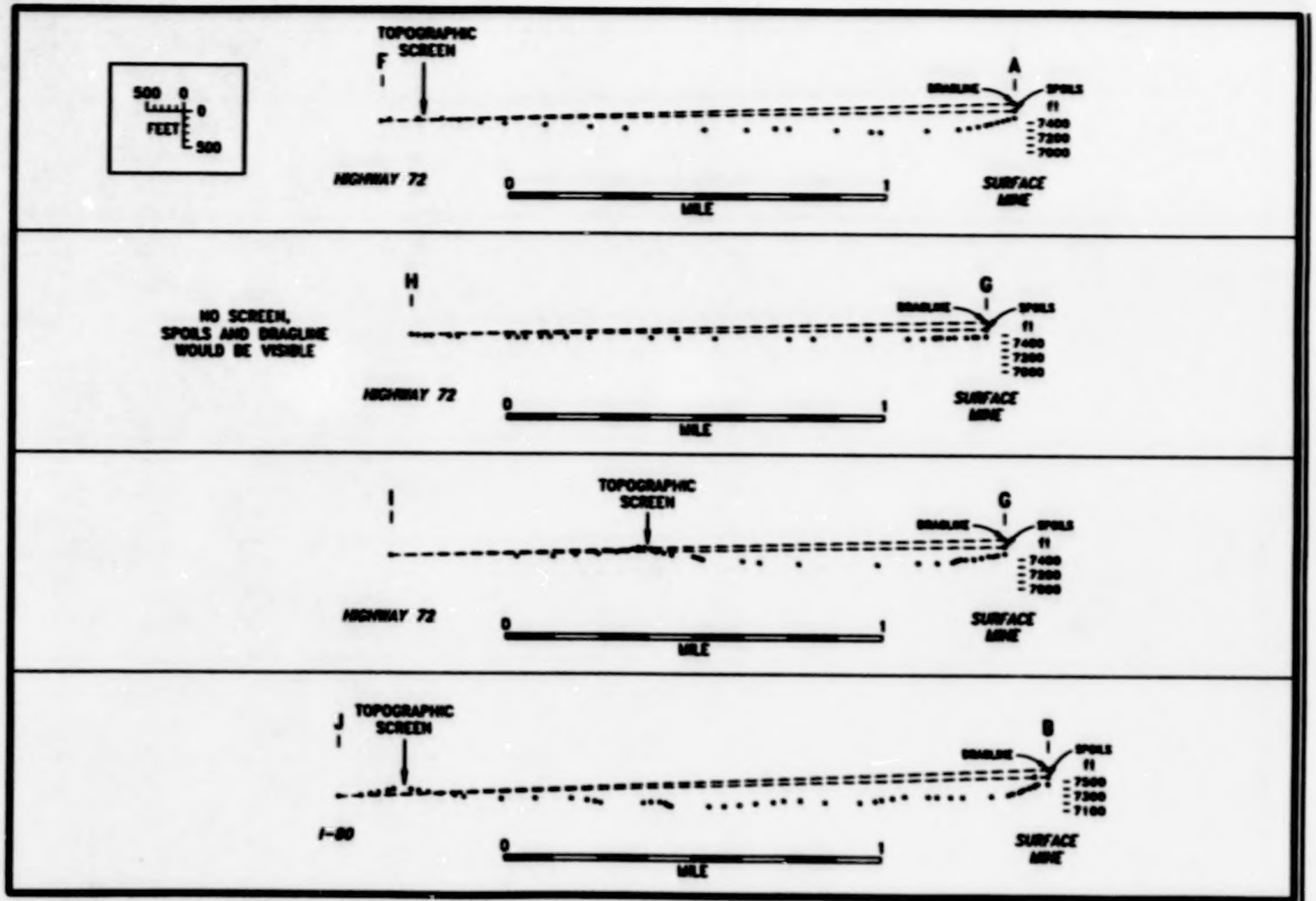

Figure C.3 Cross Sections of Topography Between I-80 or Highway 72 and the Mine.

371

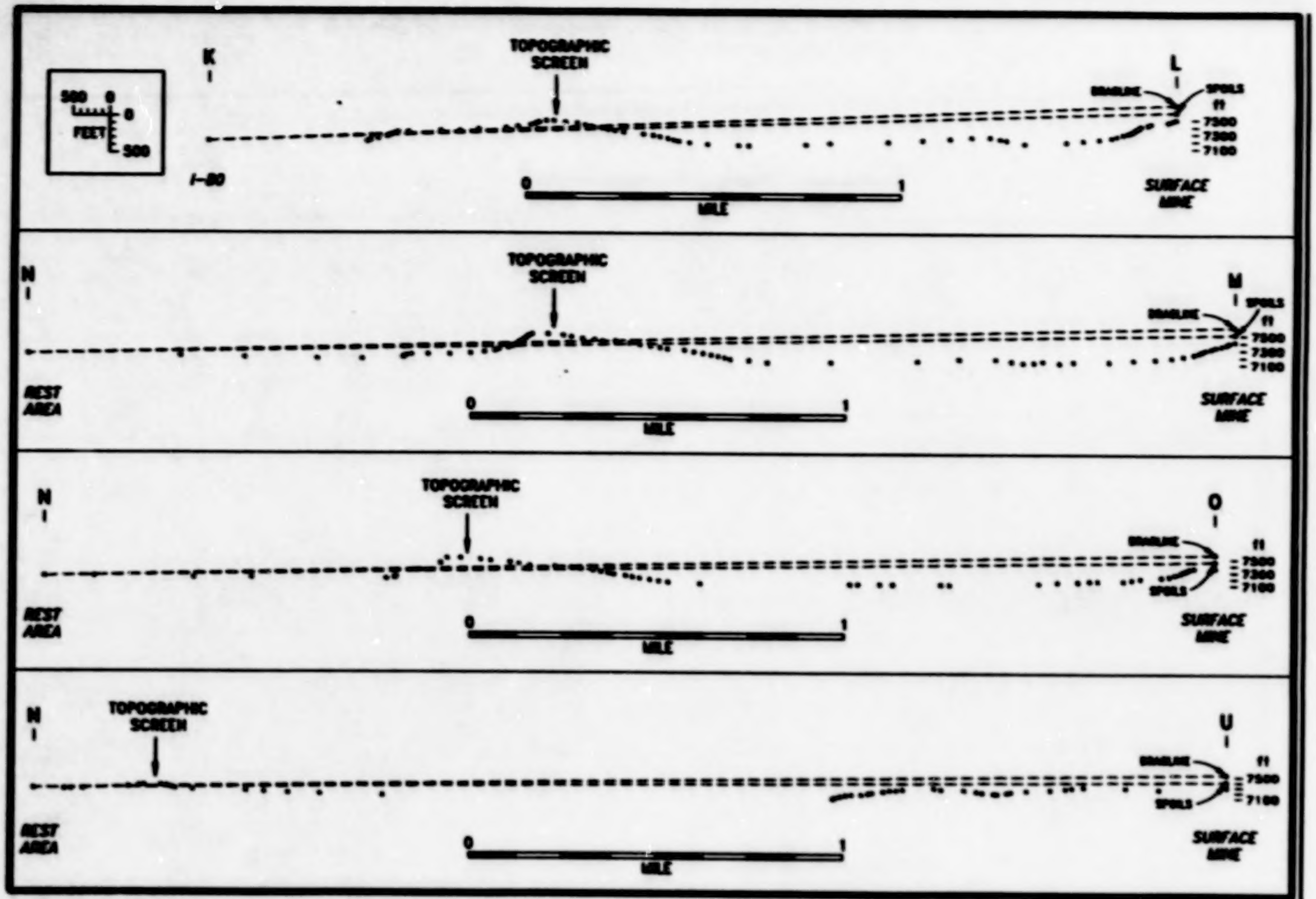

Figure C.4 Cross Sections of Topography Between I-80 or the Rest Area and Exit 205 and the Mine.

372

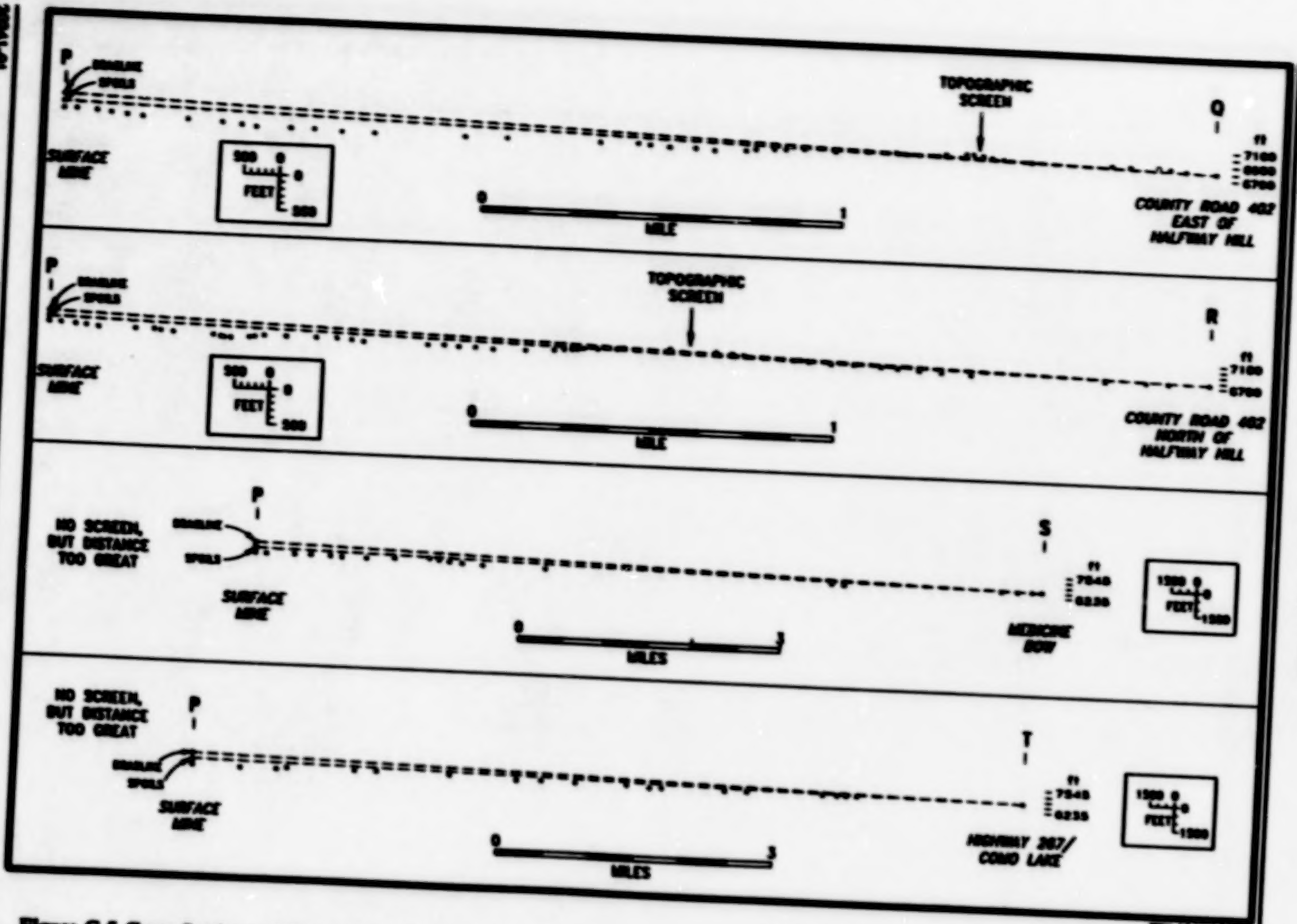

Figure C.5 Cross Sections of Topography Between Halfway Hill or Highway 30/287 and the Mine.

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END

10-28-98